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Popular Science Monthly

MAY, 1921
Volume 98-No.5

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How I Turned Work into Play at \$200⁰⁰ a Week

By David Beach

The Amazing Story of a Bookkeeper Who Without Any Previous Experience Learned the One Great Secret of Drawing in His Spare Time and Cashed in on it

"—and—Four times my former salary, and my own boss, all for a few hours delightful study!"

A man was talking to his companion in the seat behind me on my home-bound train. The cheerful enthusiasm of the voice sounded vaguely familiar. I turned to see who the speaker might be. To my surprise I recognized him as Bob Enright, an old friend, whom I had not seen since we were junior clerks together at Sims, Foreman & Co.

"What is it all about, Bob," I asked, as soon as greetings were over, "what is this wonderful job of yours? Tell me about it."

Bob laughed. "You'll be surprised when I tell you, Dave—I am an artist! Not another Rembrandt, perhaps—"

"Artist?"—I interrupted, "what do you mean?"

"Just that—A-R-T-I-S-T—I do some of the stuff you see in the Sunday newspaper magazine sections."

"But, what the dickens, Bob—when did you learn how to do it?—What have you been doing—studying abroad?"

"Not a bit of it—learned right here in U. S. A., at my own fireside. It took me only about an hour and a half to learn the whole secret. Why I drew first 'blood' three weeks after I started, and landed this position last June, just four months later!—But, listen, if you're interested, I'll tell you all about it, what do you say to lunch on Thursday. Can you make it?"

I decided that I could and met him accordingly. Bob started bubbling over the minute we were seated.

A Luncheon Talk That Changed My Whole Life

In view of his own remarkable success, his enthusiasm was excusable. He told me how Charles Lederer, the famous artist and cartoonist, had drawn upon his thirty years of experience and constructed a home-study art course along lines never before attempted. Working on a new idea Mr. Lederer had condensed the whole field of commercial art into thirty fascinating lessons. He had boiled the whole system of training down to one great principle. And so simple was it, so logically arranged that anyone, whether he had had previous experience or not, could not fail to progress easily and rapidly.

Bob insisted that if I liked to draw at all, the very best thing I could do was to get this wonderful course and give it a trial. He pointed out that bookkeeping led to nowhere (I knew this). He told me about the amazing opportunities in commercial art. He told me about the hundreds of high salaried positions vacant for

lack of trained men. He spoke of the wonderful fascination of the business, the short hours, the delight of creating—And finally, he wound up with a recommendation to start right away "knocking 'em dead."

I thought it all over. No doubt about it—I was dissatisfied. And I had always wished that I could draw. My boyhood ambition had been to be a fancy paper artist.

But, it all seemed so impossible—artists were born, not made—and I couldn't draw. However, Bob had done it, and—well, I couldn't lose anything, and the long and the short of it was that I sent for Bob's course.

A Knock-Out Surprise

Of course, I was skeptical when I received the little package of which Bob had spoken so highly. But my "Doubting Thomas" attitude changed before I had spent an hour with it.

Bob had not exaggerated. I found the "One great secret" that he had talked about, and mastered it in just one hour and ten minutes by the clock. That same evening I sketched some little pictures—and they were good.

My delight and astonishment knew no bounds. Every evening I kept at it. Although I never put in more than a couple of hours a day, I soon found that drawing could be taught as easily as typewriting or shorthand work.

The fashion angle appealed to me the most. I specialized on that, and a month later I collected some of what I considered my best work, took a day off from the office and started to look for a job.

Bob gave me names of several firms, and a letter of introduction. The second place I called at hired me on the spot at \$45 a week! Think of it, and I was only a beginner!

At Last—Real Money for Real Work

From that day on my progress has been steady and rapid. I am now head of the art department of one of the best known of the fashion magazines in the South. Every day, the one big rule that I learned in that first hour holds good. It is the basis of my entire success.

Through Mr. Lederer's amazing system, drawing can be taught as easily as anything else. And the best part of it all is, that the course teaches you to draw so that you can sell your pictures right from the start. That is really the most important part after all. Everyone wants to sell his work, and this is just what you can do, with Mr. Lederer's great secret.

Don't misunderstand. I am not praising myself. The point is this,—if I, who never was able to draw at all, could achieve this really remarkable success, others can do the same, or better,—and my salary is about \$10,000 a year. But see for yourself,—send for the course and try it out. If you can draw at all you will prob-



I developed an original style of my own

ably get along even faster than I. Remember, that opportunities in this uncrowded field are unlimited. There is a constantly growing demand for cartoonists and illustrators. Don't miss this wonderful opportunity to fit yourself in your spare time for the best paying and most fascinating profession in the world.

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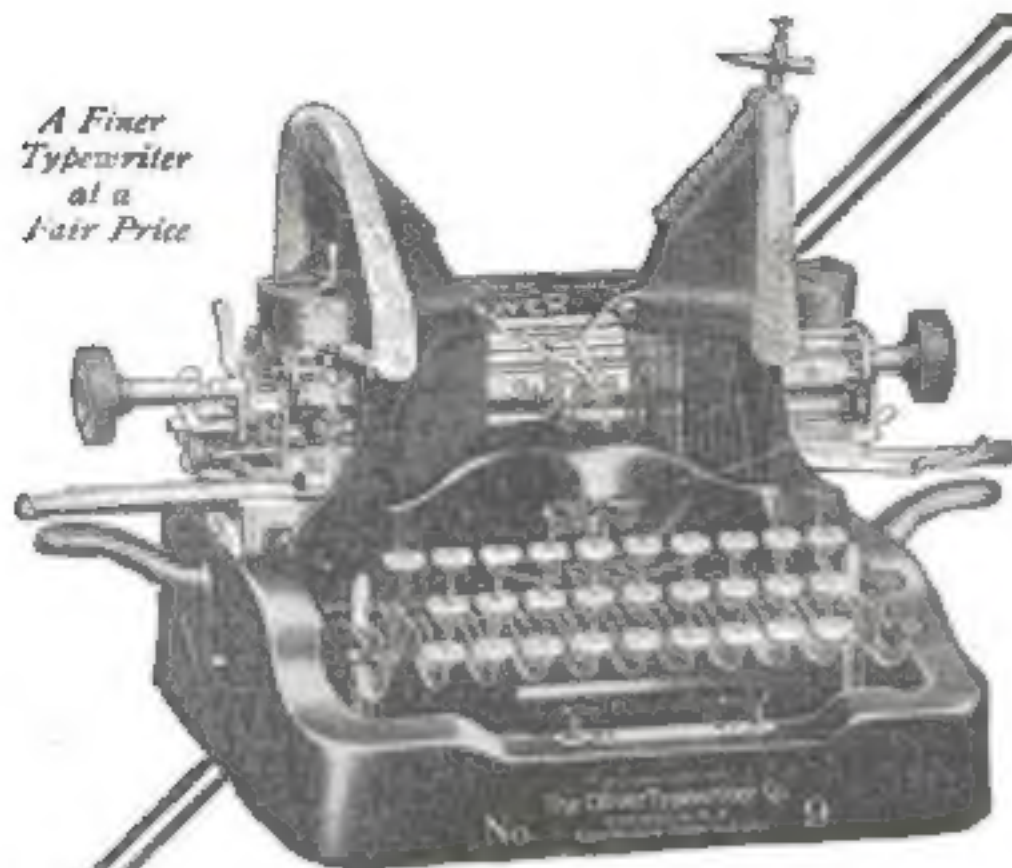
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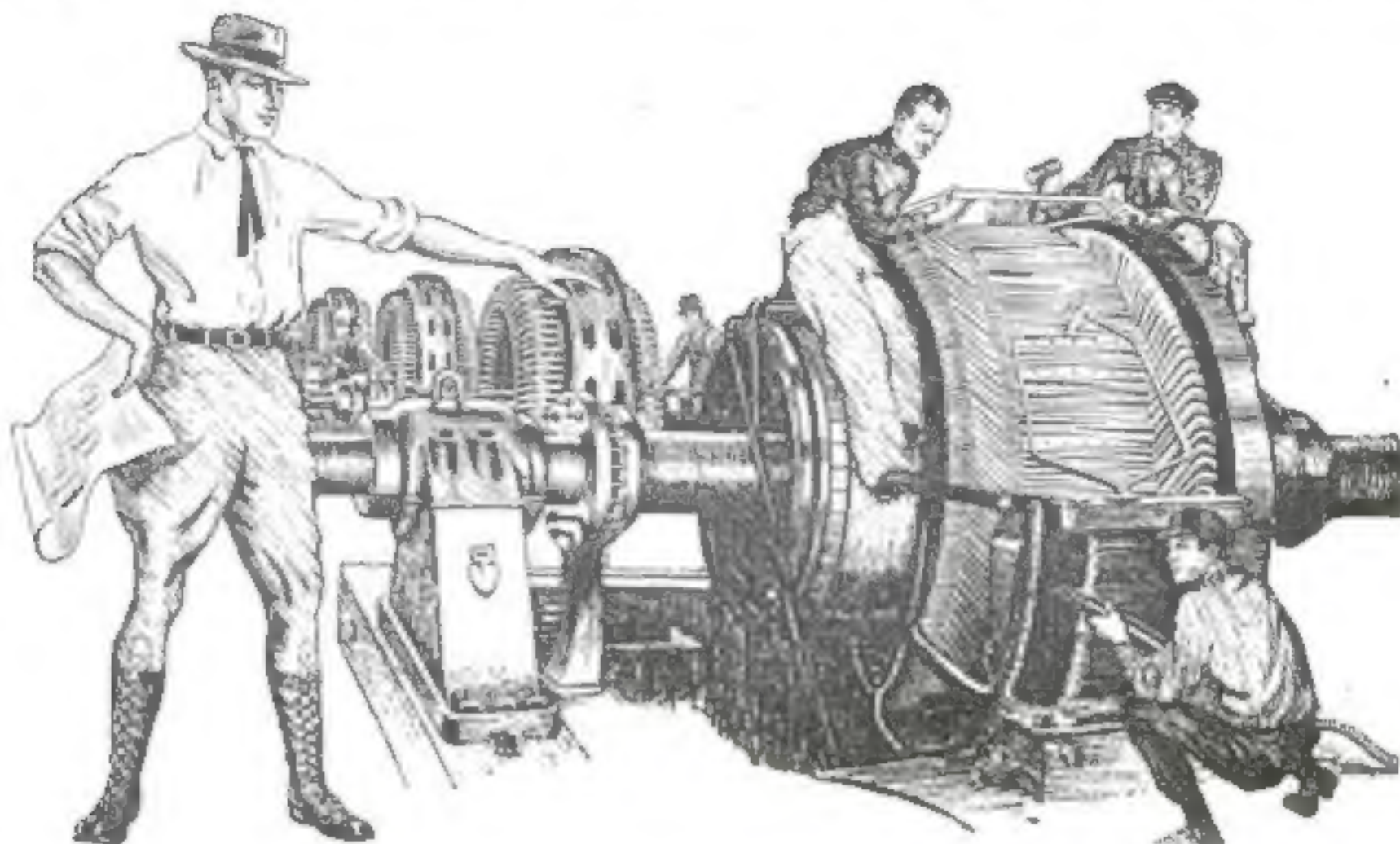
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SPEEDSTER Plans. See "Red-1-Kut" ad, page 86.

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ELECTRICAL

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ELECTRICIANS, Wiremen, Linemen, send your name and address for descriptive literature of our Modern Blue Print Chart Method of Electrical Wiring. Over 350 practical diagrams. Electrical Wiring Diagram Company, Box 8173, Atlanta, Pennsylvania.

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Popular Science Monthly Heads This List, Too

Not all magazines carry Classified advertising and not all that do are real producers. In fact there are but a small number of popular mediums with a classified section that have proved to be persistent pullers on mail-order advertising. And the man with a live proposition will find too few publications with a proved reputation for direct results. But even the the available number of mediums is small, the wise Classified advertiser will endeavor to eliminate the "dead wood" and use only those magazines which have been found to pay. On some lists there are a dozen or more real pullers; on others, perhaps only four or five. But in practically every case Popular Science Monthly is among the winners. Here's but one instance:

Popular Science Monthly,
225 West 39th Street,
New York City.

Gentlemen:

Please insert the following advertisement in the April issue under Motion Pictures.

After testing out the different magazines as to drawing power, we find that Popular Science Monthly and one other have the rest of them out-classed. We intend to use your magazine regularly.

Very truly yours,
WERNER BROTHERS.

For Further Information Address

Classified Advertising Manager

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New York City

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WANTED—Representatives in every factory in the United States. Popular Science Monthly, 225 West 39th Street, New York.

CASH: Paid! If you want all your goods are worth, mail us your discarded jewelry, gold crowns, bridges, watches, diamonds, silver, platinum, magnets and contact points. We pay \$1.00 to \$25.00 per set for false teeth (broken or new)—Money sent by return mail. Packages held 5 to 12 days and returned at our expense if our offer is not satisfactory. Send to the old Reliable United States Smelting Works, Dept. 81, Chicago, Illinois.

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WE do Metal Stamping, Gold, Silver, Nickel, Brass and Copper finishing. We will manufacture your article either on time or contract basis. If interested in large production write us. When on your die work you are always welcome at our die-maker's bench. Denning Mfg. Company, 1775-1777 East 87th Street, Cleveland, Ohio.

TOOLS AND SUPPLIES

SENSITIVE drill press castings. Working drawings 50 cents. Send for particulars. R. C. Swanson, 7920 Cole Avenue, Chicago.

DUPLICATING DEVICES

OUR "Modern" Duplicator reproduces 50 to 75 duplicate copies from each pen, pencil or typewritten letter, drawing, blueprint, or anything, saves you money. Need one? Letter also \$5.00. Send for free. J. V. Durkin, Reeves Company, Mfg., Pittsburgh, Pennsylvania.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

MOTORCYCLES, BICYCLES, SUPPLIES

USED motorcycle parts half price. Schuch Cycle Company, 1922 Westlake, Seattle, Washington.

SEND for big list of slightly used Motorcycles on easy payment plan. Howard Cycle Company, 182 N. Broad Street, Trenton, New Jersey.

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FOR sale—30 used bicycles, mid-guard and coaster brake, \$15.00 to \$35.00 with over, balance C. O. D. Indian Motorcycle Agency, Hudson, New York.

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HANDMADE Toy Boats in 18 models. Charles B. Burr, Elkhart, Maryland.

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FREE—Formula Catalog. Laboratories, Burlington Building, Chicago.

ANY Formula \$1.00. Douglas Chemicals, 1530 South Turner Avenue, Chicago.

AVIATION

THE American School of Aviation announces a new correspondence course in Mechanics of Aviation. A thorough training in practical aeronautics. American School of Aviation, Dept. 1875, 3001 Michigan Avenue, Chicago.

INVENTORS desiring information write for our Free Illustrated Guide Book and Evidence of Copyright Blank. Send model or sketch of invention for our opinion of its patentable nature. Highest references. Prompt service. Reasonable terms. Victor J. Evans & Company, 151 Ninth, Washington, D. C.

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STAR Jr. Biplane Plans, \$3.00. Circular "P" with Special Offer, 5c. 1921 Supply Catalog 15c. Chicago Aero Works, 326 River.

AVIATION-MOTOR 50-40 H.P. 2 cyl. opposed air cooled, weight 124 lbs. Ideal motor for light aeroplanes, motor sleds, wind wagons, hydroplanes, etc. Price only \$325—complete with propeller ready to run. Aircraft Company, 334 Coney Island Avenue, Brooklyn, New York.

"RIGHTFOOT" Trainer Biplane. Assemble your own from ready-made parts. Payments, \$10 per month. Drawings and instructions for assembling plane, remodeling motor and flying included free. Aviation Engineering Company, Lawrence, Kansas.

LABORATORY AND CHEMICAL

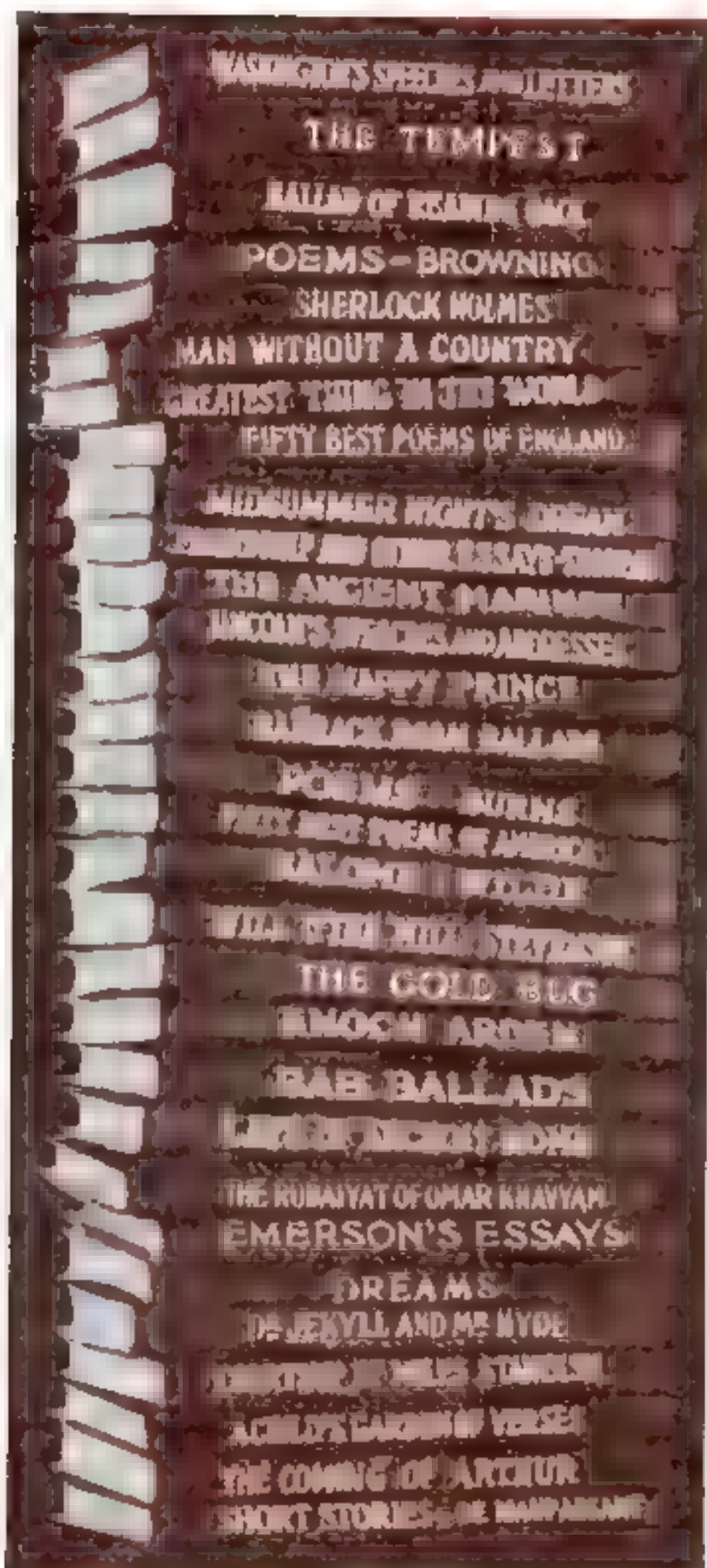
ILLUSTRATED Chemical Cyclopaedia Catalog, 16c. Anodo Apparatus Company, 3114 Fourteenth Street, Washington, D. C.

ELECTRICAL Furnaces, microscopes, scientific instruments and books are illustrated and described in our new catalogue which has just been issued. Information from D. Alton Company, 223-225 East 110th Street, New York.

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Why I Cried After the Ceremony

Two whole months I planned for my wedding day. It was to be an elaborate church affair, with arches, bridesmaids and sweet little flower-girls. Bob wanted a simple ceremony—but I insisted on a church wedding.

"We are only married once, you know," I laughed. "And oh, Bob," I whispered, nestling closer, "it will be the happiest day of my life."

Truly I planned for that happy day and proudly I loaded the shimmering folds of my wedding gown. There were flowers to be ordered, music to be selected and cards to be sent. Each moment was crowded with anticipation. Oh, if I could have only known then the dark cloud that overshadowed my happiness.

At last the glorious day of my marriage arrived. The excitement fanned the spark of my happiness into glowing and I thrilled with a joy that I had never known before. My wedding day. The happiest day of my life! I just knew that I would remember it forever.

A Day I Will Remember Forever

How can I describe to you the beauty of the church scene as I found it when I arrived? Huge wreaths of flowers swung in graceful fragrance from the ceiling to wall. Each pew boasted its cluster of lilies, and the altar was a mass of many-hued blossoms. The bridesmaids, in their flowing white gowns, seemed almost unreal, and the little flower-girls looked like tiny fairies as they scattered flowers along the carpeted aisle. It was superb. I firmly believed that there was nothing left in all the world to wish for. The organist received the cue, and with a low, deep chord the mellow strains of the triumphant wedding march began.

Perhaps it was the beauty of the scene. Perhaps it was the strains of the wedding march. Perhaps it was my overwhelming happiness. At any rate, the days of rehearsal and planning vanished in a blur of happy forgetfulness, and before I realized what I was doing, I had made an awful blunder. I had made a mistake right at the beginning of the wedding march, despite the weeks of careful preparation and the days of strict rehearsal!

One Little Mistake—and My Joy is Ended

Some one giggled. I noticed that the clergyman raised his brows ever so slightly. The sudden realization of the terrible blunder I was making caused a pang of regret that I had not read up, somewhere, about the blunders to be avoided at wedding ceremonies. A hot blush of humiliation surged over me—and with crimson face and trembling lip I began the march all over again.

It all happened so suddenly. In a moment it was over. And yet that blunder had spoiled my wedding day! Every one had noticed it. They couldn't help noticing it. All my rehearsing had been in vain, and the event that I had hoped would be the crowning glory of my life, proved a miserable failure.

Of course, all my friends told me how pretty I looked, and the guests proclaimed my wedding a tremendous success. But deep down in my heart I knew that they did not mean it—they could not mean it. I had broken one of the fundamental laws of wedding etiquette and they would never forget it. After the ceremony that evening I cried as though my heart would break—and, incidentally, I reproached myself for not knowing better.

I Buy a Book of Etiquette

After the wedding there were cards of thanks and "at home" cards to be sent. The wedding breakfast had to be arranged and our honeymoon trip planned. I determined to avoid any further blunders in etiquette and so I sent for the famous Encyclopedia of Etiquette.

Bob and I had always prided ourselves on being cultured and well-bred. We had believed that we followed the conventional society to the highest letter of its law—the serious breaches of etiquette we were almost every day!

Why, after reading only five pages, I discovered that I actually did not know how to introduce people to each other correctly. I didn't know whether to say: *Mrs. Brown meet Mr. Smith*, or *Mr. Smith, meet Mrs. Brown*. I didn't know whether to say: *Bob, meet Mr. Blank* or *Mr. Blank, meet Bob*. I didn't know whether I were proper for me to shake hands with a gentleman upon being introduced to him, and whether it were proper for me to stand up or remain seated. I discovered, in fact, that to be able to establish an immediate and friendly acquaintance between two people who have never met before, to make conversation flow smoothly and pleasantly is an art in itself. Every day people judge us by the way we make and acknowledge introductions.

Blunders in Etiquette at the Dance

Bob glanced over the chapter called *Etiquette at the Dance*. "Why, dear," he exclaimed, "I never knew how to dispose of my dancing partner and return to you without appearing rude—and here it is all explained so simply." We read the chapter together. Bob and I, and we found out the correct way to ask a lady to dance and the polite and courteous way for her to refuse it. We found out how to avoid that awkward moment after the music ceases and the gentleman must wait for his partner to return to his escort. We even discovered the correct thing for a young girl to do if she is not asked to dance.

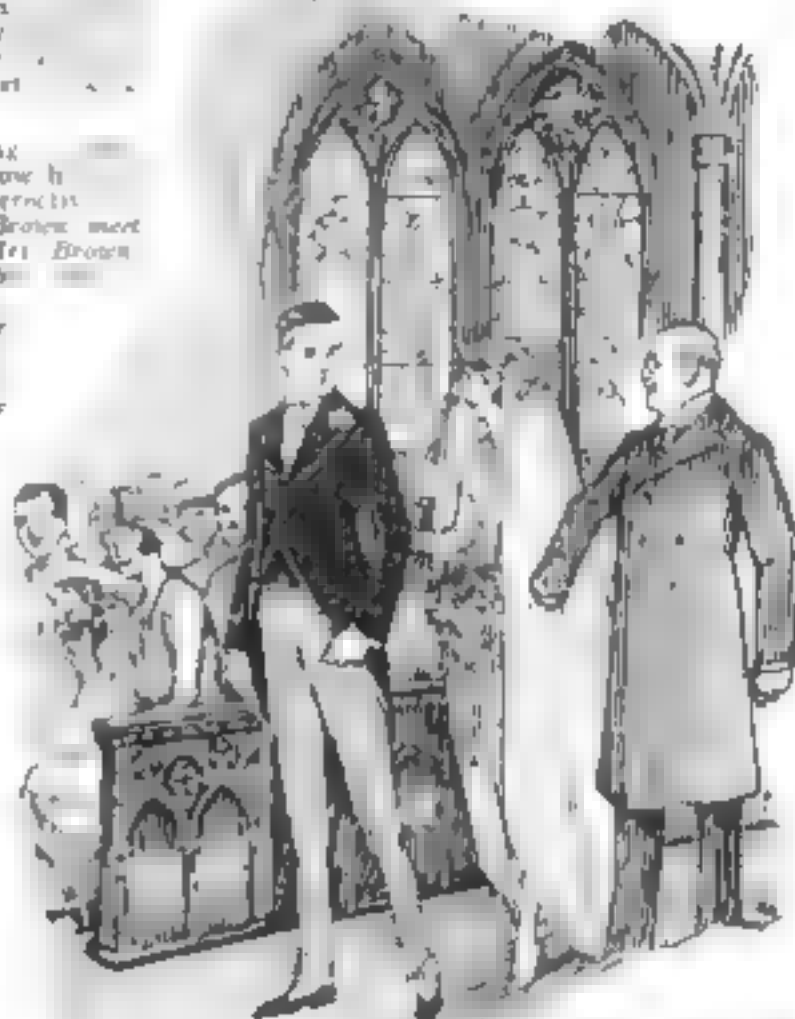
We will find invaluable aid in our Encyclopedia of Etiquette. I said to Bob: "It tells us just what to do, what to say, what to write and what to wear at a dinner. And there are two chapters I see on foreign courtesies that tell all about tips, dress, dining cards, correspondence, addressing invitations and addressing letters abroad. Why look, Bob, it even tells about the dinner etiquette in France, England and Germany. And see, here is a chapter on wedding etiquette—the very mistake I made is pointed out!" Oh, Bob, if I had only had this wonderful book, I would never have made that blunder!

My Advice to Young Men and Women

The world is a harsh order. To be admitted to society, to earn the company of brilliant minds and to win admiration and respect for oneself, it is essential for the woman to cultivate charm and for the man to be polished, impressive. And no one can adhere to the laws of etiquette, it is possible for the woman to be charming and the man to be what the world loves to call a gentleman.

I would rather lose a thousand dollars than live through that awful moment of my wedding day. Even now when I think of it I blush. And so my advice to young men and women who desire to be cultured, other than those who desire to impress by their dress and their and become a trend setter in the splendid, two-volume set of the *Encyclopedia of Etiquette*.

Send for it that you may know the correct thing to wear at the dinner and the correct thing to wear at the ball. Send for it that you may know just what to do and say when you overturn a cup of coffee on your hostess' table linen. Send for it that you may know the proper way to remove fruit stains from your mouth, the polished way to use a finger bowl and the correct way to use napkins. Send for it to assure that you may be a winner at all times. Cultured, well-bred and refined. That you may do and say and write and wear only what is the best of form and utterly in accord with the art of etiquette.



Before I realized what I was doing I had spoiled the wedding march with an awful blunder in Etiquette.

Encyclopedia of Etiquette

In Two Comprehensive Volumes

Sent FREE for Five Days

Encyclopedia of Etiquette is excellent in quality, comprehensive in scope, and as such in demand. In a revolution I would better etiquette. I have never enjoyed anything so much as to have you the right thing to do.

For a short time only the complete two-volume set of the Encyclopedia of Etiquette is being offered at the special price of \$3.50. Don't wait until your wedding, your party, your dinner is spoiled by a blunder. Don't delay—send for your set NOW before you forget.

The coupon below entitles you to a 5 days FREE examination of the two-volume set of *Everyman's Encyclopedia of Etiquette*. At the end of this time if you wish to keep it, simply send us \$3.50 in full payment and the work is yours. If you are not fully satisfied, return the books to us and you will be refunded.

Send for your set of the Encyclopedia to-day. Surprise your friends with your knowledge of the correct thing to do, say, write and wear at all times. Just mail the coupon—don't send any money. Nelson Doubleday, Inc., Dept. 255 Oyster Bay, New York.

NELSON DOUBLEDAY, INC.
Dept. 255, Oyster Bay, New York

Gentlemen:

You may send me the complete two-volume set of the *Encyclopedia of Etiquette*. After 5 days I will either return the books or send you \$3.50 in full payment. This places me under no obligation.

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I really do not see how a better system than yours could be devised. My old system required ruled lines and five positions. This Paragon is very easy to read and write on just blank paper too. R. W. MYERS, 1334 Prospect Ave. Toledo, Ohio.

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With reasonable application you will have learned Paragon at the end of a week. If your purpose is to use it for making your own memoranda, you can then begin using it at once. But, if your object is to prepare for a shorthand position then, at the end of a week you will start speed practice to acquire the necessary speed. Numbers have been able to take positions in a month, two months or three months. It all depends on the time per day devoted to practice. In public schools, on account of many additional studies, the shorthand course is made to last as long as the other courses—two or two years.

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Remember how many of the biggest men in America got their start because they could write shorthand. Frank A. Vanderlip, George B. Cortelyou, William Lueb, Jr., Edward Bok and other men of highest achievement.



Try This Lesson Now

Take the ordinary longhand letter . Eliminate everything but the long downstroke and there will remain . This is the Paragon symbol for A. It is always written downward.

From the longhand letter  rob out every thing except the upper part—the circle—and you will have the Paragon E. .



Write this circle at the beginning of  and you will have Ed. .

By letting the circle remain open it will be a hook, and this hook stands for A. Thus  will be Ad. Add another A at the end, thus  and you will have a girl's name, Ada.

From  eliminate the initial and final strokes and  will remain, which is the Paragon symbol for O.

For the longhand , which is made of 7 strokes, you use that one horizontal stroke .

Therefore,  would be Me.

Now continue the E across the M, so as to add D—thus  and you will have Med. Now add the large circle for O, and you will have  (Meadow), which is Meadow, with the silent A and W omitted.

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Garage Owner

There is 20-year old Ben Kewer, M. S. A. S. graduate at Pulaski, Va. He has done \$43,810 worth of business with \$10,000 profit in six months.



Manufacturer

C. F. Swanson of Sioux City, Ia. He is training at the M. S. A. S. M. Swanson was working by the day. He now has a business of his own and makes over \$500 a month. He manufactures plates, rings and operates a garage.



Salesman

W. E. Fink of Madison, Mo. came to the M. S. A. S. to learn what a salesman should know. When he finished his course he got the agency for the T. and S. Spring for three years, the selling machine and is making good.



Farm Lighting Plant Expert

There is D. J. Hill, the W. and L. Light dealer at Copper, Va. He trained the business at the M. S. A. S. and is now making big money.



Mechanic

Carl Wright, a M. S. A. S. graduate only 18 years old, is a mechanic. A few weeks at M. S. A. S. training doubled his wages. He now makes over \$40 a week.



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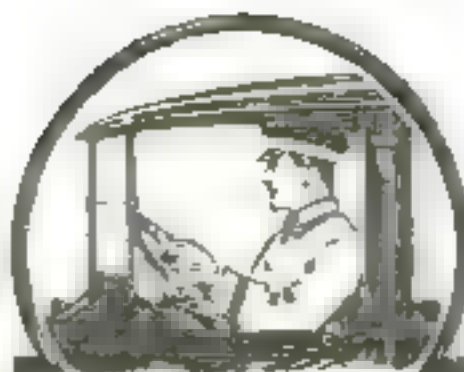
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Deixen-nos:

What Is Nerve Force?

By PAUL von BOECKMANN

Nerve Specialist and Psycho-Analyst

EXACTLY what Nerve Force is, we do not know. If we did know, we would know the Secret of Life. We know that it is generated by the Nervous System through which it travels at a speed greater than 100 feet per second. It is the Master Force of the Body, the force that controls every heart beat, every breath, the digestion of every mouthful of food we eat, the action of every muscle, and the life of every cell. It is the force that gives us courage, ambition, personality, character, mental power and energy—the Force that Drives us On, On and On.

Every mental impulse and every bodily act uses up a certain amount of Nerve Force. If we expend more Nerve Force than the system can develop, we necessarily become Nerve Bankrupts, and we then have a condition known as Neurasthenia, Nervous Debility, Nervous Prostration or Nerve Exhaustion. Since the greatest drain of Nerve Force is by way of the brain, it can easily be understood why mental strain, worry, grief, and, of course, abuse of the reproductive functions, wreck the nerves so readily.

Nine people out of ten have weak nerves and are not aware of it. They think because their hands do not tremble, muscles twitch or knees shake, that their nerves are perfect. Bear in mind that our nervous system consists of two great branches, the External and the Internal Organic derangements and ailments are due to weakness of the Internal Nervous System, and not the External System, which mainly governs the external muscles. Note the accompanying diagram.

The symptoms of Nerve Exhaustion vary according to individual characteristics, but the development is usually as follows:

First Stage: Lack of energy and endurance that "tired feeling."

Second Stage: Nervousness, restlessness, sleeplessness, irritability, decline in sex force,

loss of hair, nervous indigestion, sour stomach; gas in bowels; constipation, irregular heart; poor memory, lack of mental endurance; dizziness; headache, backache, neuritis, rheumatism and other pains.

Third Stage: Serious mental disturbances, fear, undue worry; melancholia; dangerous organic disturbances—suicidal tendencies and in extreme cases, insanity.

If only a few of the symptoms mentioned apply to you, especially those indicating mental turmoil, you may be sure that your nerves are at fault—that you have exhausted your Nerve Force.

I agree with the noted British authority on the nerves, Alfred T. Schofield, M.D., the author of numerous works on the subject.

Publisher's Note. Prof. von Boeckmann is the scientist who explained the nature of the mysterious Psycho-physic Force involved in the Coulter Abbott Factor, a problem that had baffled the leading scientists of America and Europe for more than thirty years, and a full account of which appeared in the March and April issues of Physical Culture Magazine.

who says, "It is my belief that the greatest single factor in the maintenance of health is that the nerves must be in order."

Hundreds of books have been written by Nerve Specialists intended as a guide in caring for the nerves and restoring nerve force. Unfortunately, these books do not meet the need of the general public as they are written in technical and complex language. I have written a 64-page book entitled "Nerve Force," which in the simplest language explains hundreds of vital points regarding the nerves and their care, information every person should know. Students of the subject, including physicians, pronounce the book the most practical work on the subject which has ever been written. Large corporations have bought my book by the thousands for their employees. Physicians recommend it to their nervous patients. Extracts from the book have again and again been reprinted in magazines and newspapers.

which is the latest proof of real merit. The cost of the book is 25 cents. Send in your stamp and I will start a leatherette cover for you. I have advertised my various books in this and other big class magazines for more than twenty years, which is ample guarantee of my responsibility and integrity. The book does not meet your slightest expectations, I shall return your money PLUS your outlay of postage. So send for my book today, subject to my guarantee.

The following are extracts from letters from people who have read the book and were greatly benefited by the teachings set forth therein.

I have gained 12 pounds since reading your book, and I feel stronger. I had almost given up hope of ever finding the cause of my low weight.

Your book did more for me in indigestion than two courses in dieting.

My heart is now regular again and my nervousness has disappeared. I thought I had heart trouble but it was simply a case of abused nerves. I have re-read your book at least ten times.

A woman writes: "Your book has helped my nerves wonderfully. I am sleeping so well and in the morning I feel so rested."

The advice given in your book in relaxation and calming of nerves has cleared my brain. Before I was half dizzy all the time.

A physician says: "Your book shows you have a scientific and profound knowledge of the nerves and nervous people. I am recommending your book to my patients."

A prominent lawyer in Ansonia, Conn., says: "Your book saved me from a nervous collapse, such as I had three years ago. I now sleep soundly and am gaining weight. I can again do a real day's work."

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Enclosed find 15c or 30c for your book "Nerve Force." Print name plainly.

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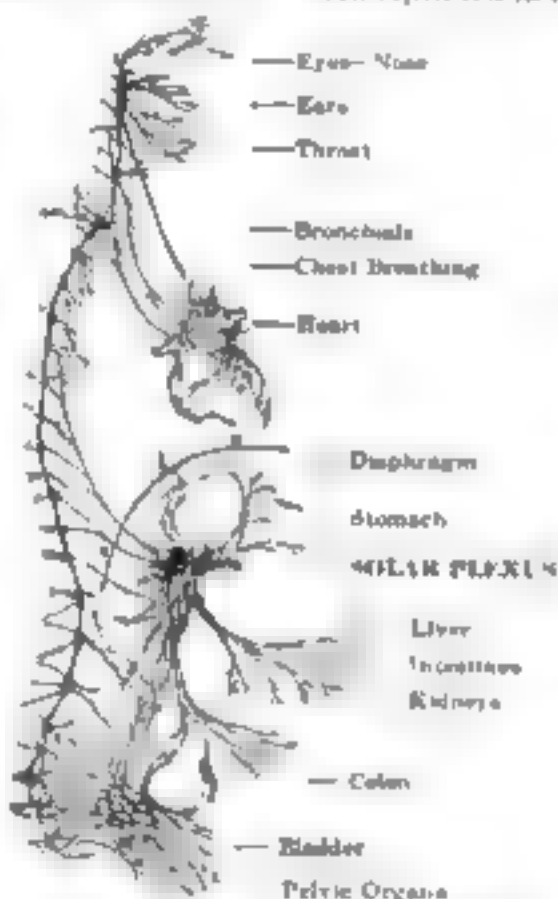


Diagram showing the location of the Solar Plexus, known as the abdominal brain, the great center of the Sympathetic Nervous System. The Solar Plexus is a central point in the upper abdominal region, where the vagus nerve and other nerves of the sympathetic system converge. It is described as the "great center of the Sympathetic Nervous System" and is responsible for controlling many of the body's internal functions, including digestion, heart rate, and breathing.

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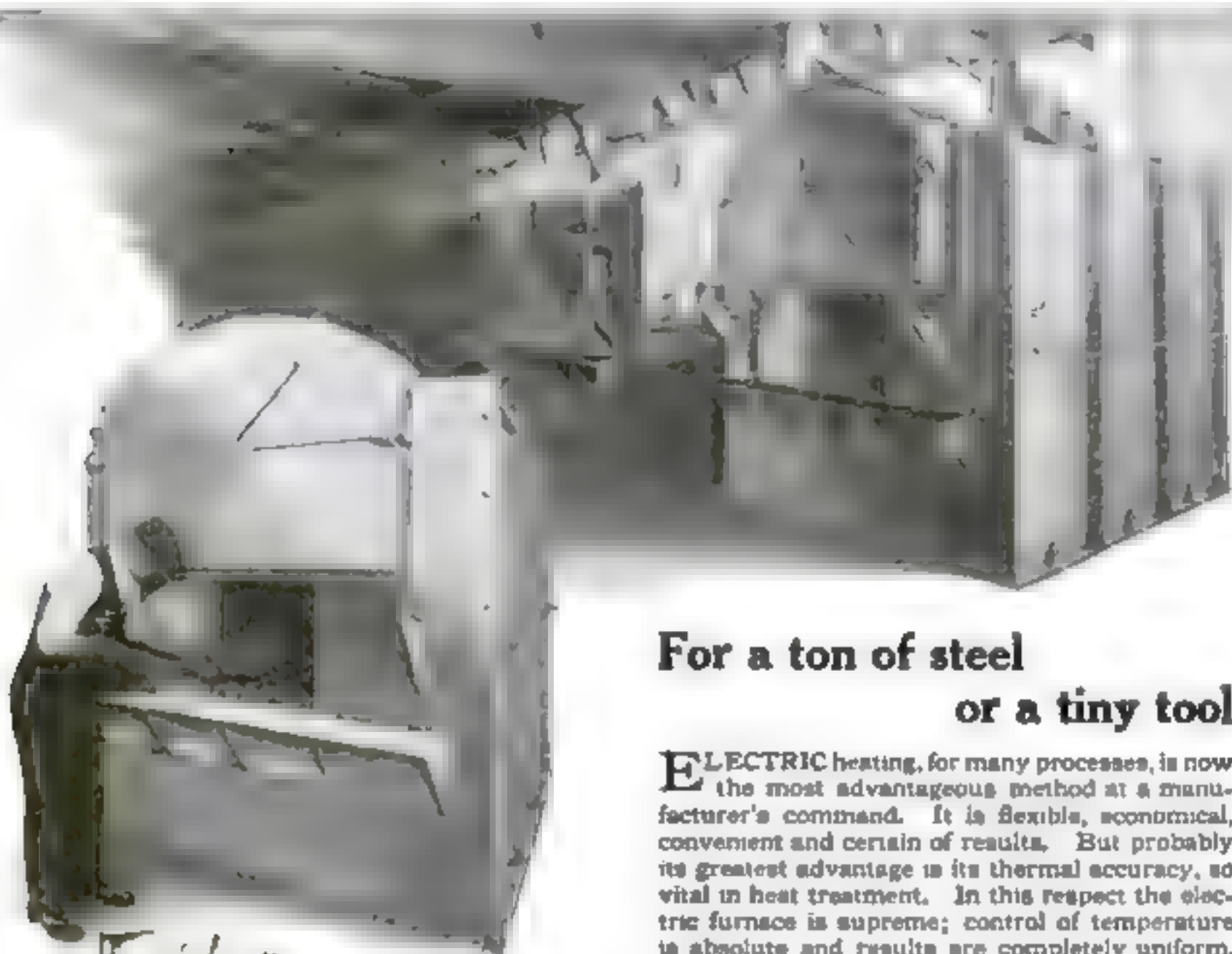
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25 Cents a Copy; \$3 a Year



Published in New York City at
225 West Thirty-ninth Street

Stunting as a Profession

Would you do the things described in this article?

By Fred Gilman Jopp

MARK CAMPBELL, the aerobut, and I were seated at the roof's edge of a new twelve-story building in lower Broadway, Los Angeles. From our position we could see the swirling mass of people on the ground below. Since early morning they had been there, gazing upward and waiting, waiting patiently for the airplane behind us to slip off to safety—or death.

Frank Clarke, the stunt pilot who was going to fly the airplane, strode over. Briefly he stood beside us, glowering down at the sea of upturned faces, then turned back to his airplane, where a mechanic was warming up the engine.

The crowd below awoke to the fact that their long wait was about to be rewarded. Arms pointed upward to where the wing projected over the street.

"Cameras ready?" shouted the motion-picture director through his megaphone.

"All ready, sir!" came the response.

The dirigible overhead gave a slight dip to signify that the cameraman aboard her was also in readiness.

Clarke, jumping into the pilot's seat, ran up his engine to make sure that it was mechanically perfect, then pulled shut the throttle. The

mechanic kicked out the chocks beneath the wheels and leaped back to safety.

"Ready—cameras!" roared the director.

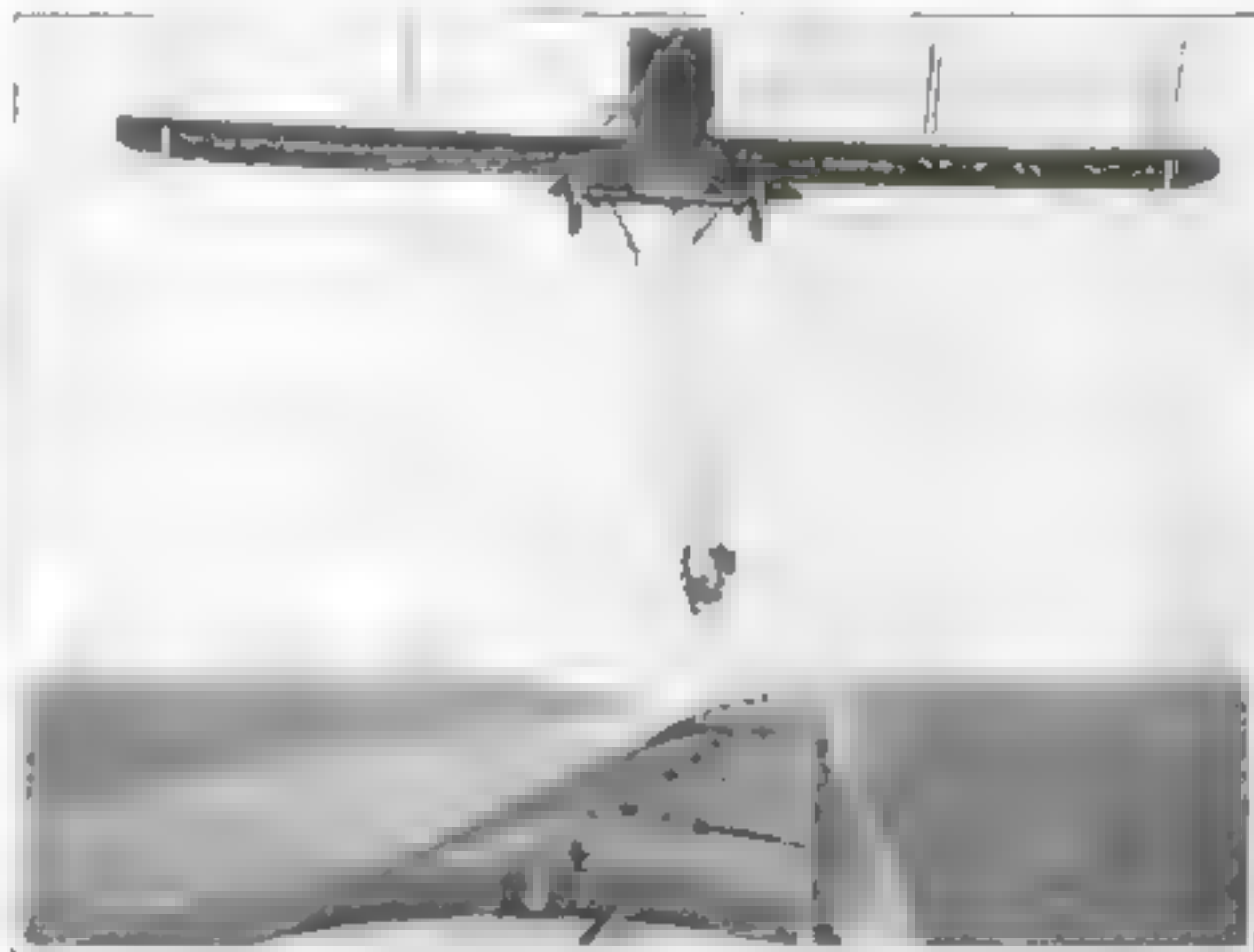
The dull, droning hum mounted, rose, grew rapidly in volume and power; the tail snapped into the air; and the airplane rolled quickly along the ninety-foot wooden runway. Thirty feet from the edge of the building, the wheels rose free of the roof; then, with a sharp jump upward, the airplane took the air like a bird. Soaring easily aloft, it banked sharply to the right, zoomed over a near-by tower,

and was off to the hangars with the grace of a bird.

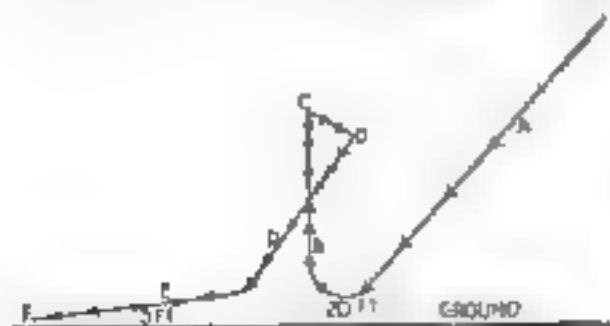
Others may flirt with death by climbing about an airplane in mid-air, but Campbell jumps for an airplane in flight. True, he uses a parachute, but his stunt is hardly less perilous because of that.

When less than 175 feet from the ground, he climbs back upon the tail, casts his parachute into the air, and lets go.

The parachute that he uses is one of the best in the world, and the United States army has contracted for the entire output of the factory. It is



Campbell stands on the train going at eighty-five miles an hour, and Clarke flies above him, trailing a ladder, and then Campbell grabs the ladder



Follow the arrow from A to F that shows how the airplane accomplishes a stunt landing known as the "whip stall"



Campbell weighs 175 pounds; thus when he crawls out on the end of the wings, great skill on the part of the pilot is needed in order to balance the plane

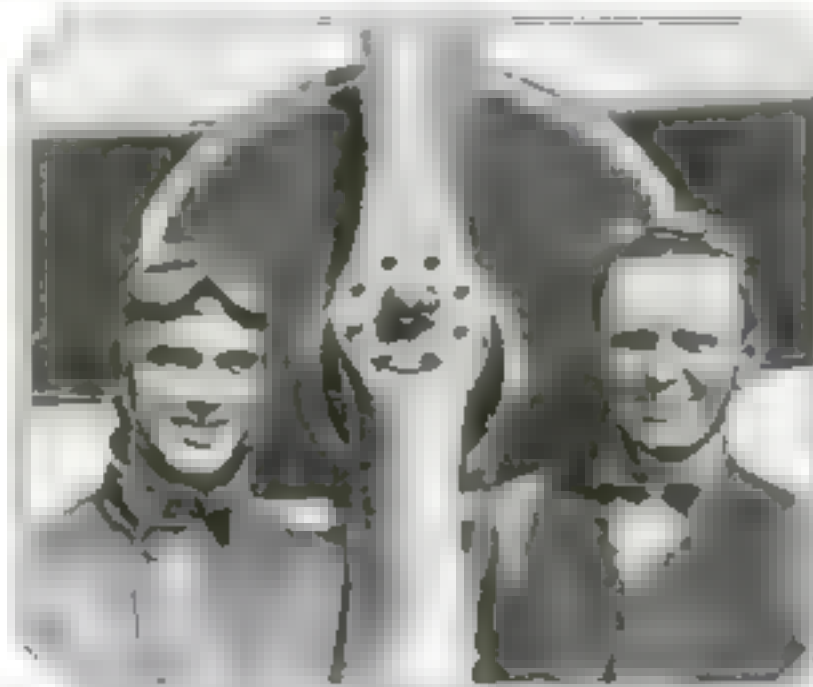
strapped on his back in a small pack. A pull of the cord on his left shoulder releases a small "chute," which in turn pulls out the large parachute. Campbell is also the only man, living or dead, who has ever jumped from an airplane to a train and back again.

"I did this stunt in California," he says. "The train and airplane were both making a speed of eighty-five miles an hour, and I made both jumps to and from the plane to the train by means of a rope ladder and nerve."

Recently Campbell was doubling for a motion-picture in which he had to fight another man on the wings two thousand feet in the air. His opponent, striving to make the fight realistic, struck Campbell with an honest-to-goodness monkey-wrench harder than he intended, knocking him senseless from the wings. He fell one thousand feet before he became conscious enough to pull the cord of his "chute." The parachute didn't open until he had dropped six hundred feet farther. The remaining four hundred feet to earth was made in safety, and Campbell grinned as he told about it. His opinion is that any one can fall to earth without losing consciousness.

Campbell weighs one hundred and seventy-five pounds, and when he gets out on the edge of the lower wing it takes unusually fine manipulations of the controls to keep the airplane balanced. The slightest miscalculation by Clarke would hurl the machine into a tail-spin, meaning almost certain death at the low altitudes in which these daredevils work.

Frank Clarke, the stunt pilot, is twenty years old, and is one of the few men who have actually taught themselves to fly. In the past three years he has lost only six weeks of flying



Here they are—Clarke, the stunt pilot, on the left; and Campbell, the acrobat, on the right

This loss was caused by an accident in which he attempted to turn a full loop under a trolley wire. A guide wire to the trolley pole tore off the left wings, yet he managed to jockey his airplane into a vacant lot before it crashed and dislocated his shoulder. Thus, you see, his title of "flying fool" is well earned. He is the first pilot to leave the cockpit with a man on one wing and to work back upon the tail to fly the airplane by operating the rudder with his feet and "flipping" the control wires by hand. He is the originator of airplane changing without a ladder, and claims the only tail-spin in history coming down tail first.

Carrying two men on the right wing is his latest stunt. And now both Campbell and Clarke are figuring on a movie contract in which Clarke is going to pick up Campbell from a descending parachute.

For a final thrill Clarke leaves the ground in a sharp zoom, climbs one thousand feet in a half circle of the field, then descends in a sharp slant to his point of take-off with his engine full on. Twenty feet from the ground he pulls back the elevators and shoots straight upward in a two-hundred-foot climb. At the peak of this climb his airplane is virtually motionless. Suddenly it begins to slide back upon its tail; but the weight of the engine pulls the nose downward, and within a nose dive it straightens out three feet above the ground, the tail swinging back and forth. Kicking the rudder straight, Clarke drops her to earth in a perfect landing.

The Tractor in the Factory

TRACTORS have found another place to work. They are not only useful on the farm, but in the factory as well. Building contractors have also been quick to apply the little tractors in hauling work about a large job. In

fact, the small gasoline tractor is always on the job where there is any hard work to be done. It pulls and tugs loads that would require several men to move them.

The tractor illustrated is the common farm type with the engine controls placed in the handle. The handle of the factory cart is fastened to the back of the tractor and the "chauffeur" sits on the front of the cart holding the tractor handles. In this way he guides the little train in and out the isles of the shop.

The gasoline tractor is offering real competition to the electrically driven type that has come into use during the past few years.



The farm tractor is coming into use in the factories. Here is one pulling a truck in a big shop

A BRITISH tramp steamer has recently been equipped with an apparatus that handles the coal from bunker to furnace, pulverizing the fuel on the way. It has been found inadvisable to grind up the coal on shore, owing to the tendency of pulverized coal to absorb moisture rapidly, cake badly, and become highly explosive.

pulverizing. Even "sweepings" may be used when thus reduced. It is claimed that 40 per cent of waste may be used without lowering the effectiveness of the coal.

The reduction in the boiler-room staff with the corresponding saving in wages, is the same as that on board oil-fired ships. In view of the present shortage of oil, many shipping men are welcoming this new method of fueling ocean-going ships.

Ear Books for the Blind

A great invention that makes it possible to produce an entire book on a single phonographic record

By Raymond Francis Yates

A GREAT humanitarian work has been achieved by Dr. Max Herz, of the University of Vienna. Dr. Herz, who is almost blind, has developed a device that means much to every sightless person.

A complete phonographic edition of Shakespeare may soon be available for sightless people at a cost of fifty cents. The

records necessary for this reproduction could easily be placed in the pocket, and the machine for their reproduction, which is a miniature phonograph, could almost be placed in a biscuit-box.

Imagine the contents of a novel placed on a small phonograph record measuring about eight inches in diameter! Such a record could be manufactured for two or three cents. A single record would offer hours of amusement for a blind person.

The application of a novel principle has made Dr. Herz's "typophonia" possible. Vocal sounds are not recorded, because the recording of such sound requires too much space. The twelve-inch phonograph record in use to-day contains space for the registration of comparatively few spoken words. Dr. Herz has not resorted to the spoken word. In its place, he has brought into use a new telegraphic alphabet made up entirely of various combinations of dots. The Morse telegraph code is made up of dots and dashes, the dash being a prolonged

sound, while the dot is a much shorter interval. In the typophonia alphabet no use is made of the dash. Dr. Herz uses two or more dots instead. These are grouped closely so as to follow one another in rapid succession. The result is like a number of dots slurred. This device greatly simplifies the alphabet and makes it possible to record more words.

The typophonia record is prepared in a very interesting manner. It was in the system of recording that Dr. Herz was confronted with a problem that taxed his ingenuity. Fortunately, he had a faithful assistant who helped him to carry out the details.

To translate a book into the typophonia code, a paper tape is first prepared. The preparation of this tape is strictly mechanical. It passes through a perforating machine that is operated by a trained typophonist. The operator strikes off the typophonia characters with a mechanical telegraph-key. A cutting device responds to the manipulation of the key, and produces corresponding perforations in the tape.

An ingenious apparatus has been developed to transfer the subject matter from the paper tape to an impressionable wax record. The perforated tape moves between two electrical contacts, which meet when a hole in the tape is reached. The meeting of the contacts closes an electric circuit, and this causes a properly regulated current to surge through an electromagnet mounted over the slowly revolving wax record. The current passing through the electromagnet moves a recording needle that is in contact with the revolving record. The movement of the needle is recorded as a dot, or a series of dots, upon the record. The tape rushes along at a compar-

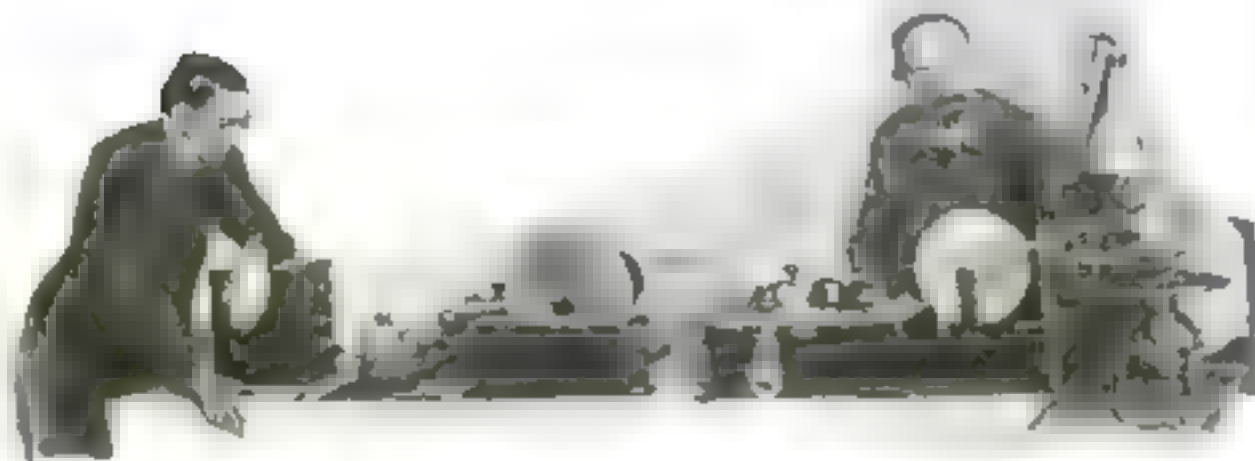
tively high speed, while the record revolves slowly. Many hundreds of yards of tape are required to fill even a small record.

When the recording process has been completed, the record is powdered with graphite to render its surface conducting. It is then hung in an electrolytic bath, and metal is deposited on its surface.

In this way an exact reproduction of the wax record is made in metal. The metal record is the master record, and, by the use of a hydraulic press and hot wax, as many duplicate records as are desired may be made.

The reproducing machine that renders the subject matter on the records audible is a phonograph of special design. No spring or electric motor is used to turn the record. This is done by hand at a slow rate. The needle moves over the record at a speed of only a fraction of an inch a second. The speed can be regulated to suit the reading capacity of the user. The hands of the user turn a wheel mounted horizontally underneath the turntable carrying the record. This wheel is geared to the turntable through a train of gears with the proper ratio.

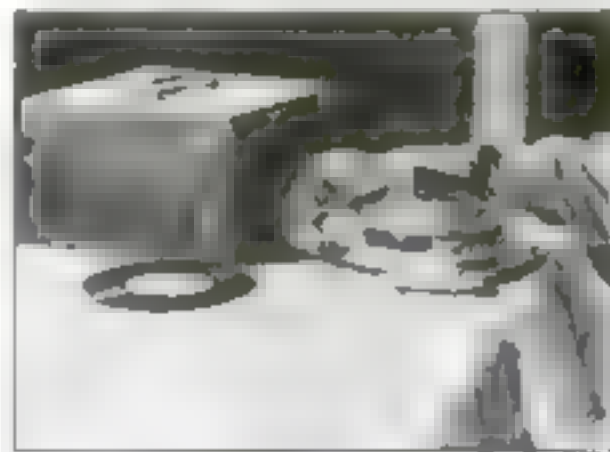
Unfortunately, the typophonia is not yet available for general distribution. It is Dr. Herz's aim to interest a philanthropist who will finance the manufacture of the device and sell it at cost.



The electrical apparatus that transfers the characters from a perforated tape to a wax record that is later used as a duplicating master record. Dr. Herz is shown at the left.



This operator is preparing the perforated tape that is used to control the electric mechanism that records the characters upon the wax disk of the master record.



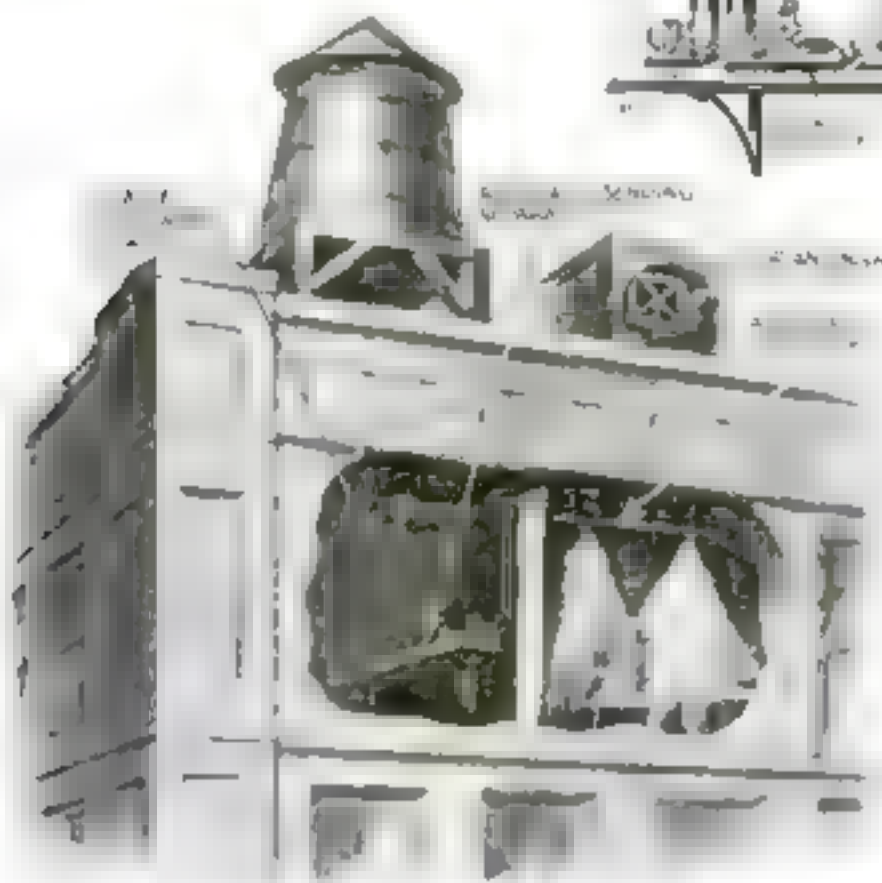
Reading ear books with the typophonia. The records are turned slowly with the hand at a speed that meets the hearing capacity of the person using it.

Water Starts Radio Alarm

IN recent years the fire hazard in factories has been greatly reduced by the use of sprinkling systems. The water is started by automatic valves that are normally kept closed by a plug made with an alloy having a low melting-point. When this is heated slightly, the alloy melts and allows the water to flow. Fire is thus quenched, but valuable goods may be damaged by the water.

Radiotelegraphy is going to find another use in preventing such damage. William Dublier, of New York city, has solved the problem by an ingenious application of radio. He would install a small radio-sending outfit in each factory, so arranged that it would automatically send a warning signal when the sprinkler started to function during the night. The signal would be received by a central station, and a messenger would be despatched to turn off the water.

When the water starts to flow in the pipe, a special device closes an electrical circuit, which in turn sets in motion an automatic sending apparatus. This automatic sender controls a small radio outfit, and when the system is disturbed, radio signals are immediately sent out.



Water flowing in the sprinkler system causes a radio outfit to call help from a central station



Since hiccoughs are caused by the spasmodic contraction of the diaphragm, pressure on the diaphragm may cure them



The disorderly nerve that causes the diaphragm to contract may be quieted by pressure on the fifth cervical nerve



The radio equipment used to call assistance. Water passing through a valve operates the radio outfit

Hiccoughs—the Cause and Cure

WITHOUT warning you are attacked by hiccoughs. Perhaps you try holding your breath—or looking at the ceiling while you swallow desperately. There are many other hiccough "cures," but few of them get at the heart of the trouble.

A hiccough is caused by the spasmodic contraction of the diaphragm, accompanied by the closing of the glottis. As the air rushes up, the epiglottis drops; and the resulting noise is the hiccough. Dr. Copeland, Health Commissioner of New York city, suggests that if you prevent the contraction of the diaphragm you will usually prevent the hiccoughs. You press your fingers under the victim's floating ribs, in the manner shown by Dr. Copeland in the picture above. In that way you reach the diaphragm.

Some months ago New York city experienced a mild epidemic of hiccoughs, which explains Dr. Copeland's interest in its cure.

Now comes the question—what causes the diaphragm to contract? The agitation of a nerve connected with it. When a man has drunk too much alcohol, for instance, this nerve becomes poisoned, and hiccoughs result.

Reviving Dead Tennis-Balls with a Pump

THERE is one thing that will bring a dead tennis-ball back to life—air. But how can air be injected into a tennis-ball so that it will stay there? By means of an instrument that looks and acts like a hypodermic syringe.

The tennis-ball itself must be specially made. Before the felt cover is placed around the inside rubber ball, a small lump of soft rubber is attached to the inner surface of the ball.

The needle of the syringe is inserted at this spot, and the handle is



The arrow points to where the pump needle is inserted. A knob of rubber beneath prevents air from escaping

pushed down. In this manner the rubber ball is given the proper degree of inflation. When the needle is withdrawn, the air pressure within causes the soft rubber to close over the hole. Next the felt cover is adjusted and a dot or small cross on the cover marks the spot where the needle was injected.

After the ball has been in use awhile it loses some of its resiliency and needs an additional charge of air. What then? You insert the needle at the marked spot and push the handle.



One Cloud's Energy Equal to that of Six Battleships

If the energy that is stored in clouds could by any means be converted into usable form, the world would have at its service one more source of power. A cloud is a mass of material so light that it floats in the atmosphere yet its particles were put there by the expenditure of energy, and this means just that much power to be put to use if it could be harnessed.

It has been estimated that the total weight of a cloud 5000 feet above the ground, and measuring

10 000 feet in diameter, would be equal to some 200 000 tons when condensed.

In tropical countries, where gigantic cumulus clouds reach into lofty mountainous heights, the actual weight of such a cloud might balance that of six battleships like the *New Mexico*.

In the past year or two much research work has been done in an attempt to wrench from nature new sources of power.

Every Cloud Is a Power House

By Latimer J. Wilson

THE mass of a great thunderhead drifting across the sky, illuminated by frequent flashes of lightning, carries within itself an immense amount of energy, or power to do work. If all that energy could be converted into a usable form, we should have at our service a new source of power.

How can there be great weight and power where material is so light that it can remain suspended in the air? A cloud is indeed a mass of material so light that it floats in the atmospheric ocean, an "iceberg" of vapor wholly suspended and submerged in the air. Nevertheless, its particles were put there by the expenditure of energy, and the force capable of lifting the weight of the material of the cloud has put into the mass just exactly that much power to do work.

What a Thunderhead Weighs

Consider a mass of vapor five thousand feet above the ground reaching fifteen thousand feet skyward and measuring ten thousand feet in diameter. It is not a mass of exactly cylindrical form, but irregular, and dome-shaped or "mushroomed" on the top.

For convenience we may consider the cloud as a gigantic block having a square base and oblong sides. The volume of such a mass would then be two thousand billion cubic feet. This is not a mass too great for a thunderhead. Some clouds are larger, and others scattered smaller masses that on the whole, would surpass our example in size.

The warm air drank in the moisture evaporated from land and sea. The surrounding pressure of cooler air

caused the warm mass to ascend like a hot-air balloon. You can see these thunderheads mounting skyward on a warm summer day. The rising speed averages more than one hundred feet a minute, and is gradually reduced as the top of the cloud reaches the point where it is cooled to the degree of the surrounding air. The process of cooling under pressure "squeezes" the moisture out of the heated air, and, in the form of minute globules formed on dust nuclei, it drifts in the currents.

The cloud assumes various shapes as the transition takes place. Often the top of the thunderhead bursts out in surprisingly beautiful mushroom forms and stands in the sky like a vaporous toadstool reared in an interval of a few minutes as if by magic.

The rising atmosphere really cools by the work of expansion, and this occurs as the pressure decreases.

But within the cloud violent forces are at work. The pressure of surrounding cooler bodies of air rush into the forming mass with the strength of a hurricane. The globules of water are massed together into drops of rain, and these are hurled upward with the currents. Sometimes they are carried high into the region of freezing temperature and are congealed into ice. The lumps of ice fall, and then a severe hailstorm descends beneath the thunderhead.

The friction resulting between the violent elements of disturbance produces fields of static electricity and lightning flashes from point to point in the cloud. Hence the name "thunderhead." It is thought that the elec-

trical energy is due to the separation or rupture of the raindrops themselves.

Assuming the cloud to be composed of water vapor to the point of saturation at freezing, the total weight of the condensed cloud would be about 200,491 tons. A battleship the size of the *Iowa* displaces 43,000 tons of water. The cloud then would have the displacement of four ships the size of the *Iowa*. If all of the water in such a cloud were suddenly precipitated upon the ground, imagine the fury of the cloudburst.

Tons of Moisture Lifted

This vast amount of water would normally be spread over an area nearly two miles square. But imagine the deluge if all of the water in the cloud could be converted into a single channel and poured as through a funnel on one small spot upon the landscape!

It is interesting to conceive of the subtle force of nature that can lift this huge load of material to the height of the cloud. Working against gravity, the sun through its warmth evaporates the moisture from land and sea, and without the aid of man is able to lift tons of invisible moisture high above every square mile of the earth's surface.

Here, then, is an inexhaustible source of energy, if we could but harness it. Only that part of the water that collects upon high places, mountain basins and plateaus, are we able to use. The waterfalls from the clouds offer unheard-of opportunities which are yet far beyond the reach of men.

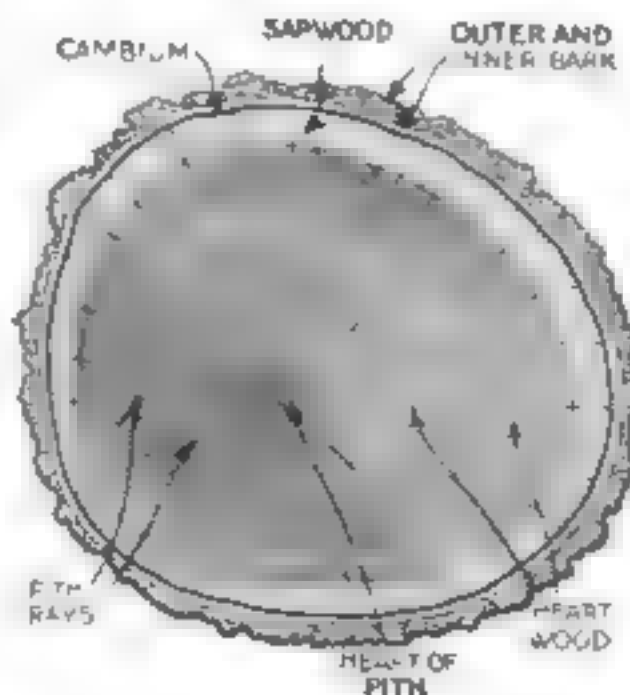
How to Tell the Age of a Tree

WORKING from the outside in, when studying a tree's growth, the bark is the first consideration. It is of a corky nature and is composed of dry dead leaves. The bark protects the tree against evaporation and outside injury.

Beneath the outer bark is the inner bark, which is soft and moist. It carries the food that is prepared by the leaves to all parts of the tree. Very gradually, this inner bark becomes the outer bark.

The next layer, known as the cambium, is where the actual growth of the tree takes place. It is a thin layer of living cells that divide and subdivide, forming on the inside wood and on the outside bark.

Below the cambium we find sapwood, which carries sap from the roots to the leaves. Heartwood composes



How a tree tells its history—the "cambium" shows the years it has to its credit

the next layer in most trees, though not every tree has heartwood.

In the very heart of the tree is the pith, around which the first woody growth is formed. From this heart of pith extend rays, connecting the pith with the various layers of wood and the bark, and also storing up food.

Each season's growth is known as an annual ring. Count these rings and you have the age of the tree.

It is important, particularly in the United States, that the owners of land containing an appreciable number of trees should become familiar with the various species—their value as lumber or for shade, also the age at which it is best to chop them down. And it is well to remember that for every tree that is chopped down another one, or even more than one, should be planted for the use of those who come after.



Every beaver dam, it has been estimated, costs the state ninety dollars, the beavers destroying valuable trees to carry on their work.

Why Beavers Must Go

SIX years ago there was no sign of beavers in the Adirondacks. Today the forest is full of them and their work is everywhere. This comes as a result of restocking the Adirondacks with thirty-four beavers in 1906 and 1907. There are from ten to twenty thousand dam-builders in almost every watercourse and lake.

Rangers of the Conservation Commission of New York state have inspected 587 dams, which flood 8681 acres of forest land, covering with water \$61,425 worth of valuable timber. It is estimated that every beaver dam costs the state ninety dollars. The destruction will increase rapidly. The beavers cut birch, poplar, cherry, and other trees, many of which are a foot or more in diameter. They girdle and kill many larger ones and flood many acres, thus drowning the roots of priceless timber, especially pine, spruce, and balsam.

Something must be done to curb the destruction. This will probably be accomplished by means of an open trapping season next year. It is interesting to remember that when the white man came there must have been more than a million beavers, for the simple mind of the redskin associated the beaver with the creation of the world and revered the creature too much to kill it.

The invention of the steel trap about 1794, and the use of castoreum as a bait, together with the great demand for beaver hats in that period, took a terrible toll of animals. By 1895 there were probably not more than five beavers in all New York state.

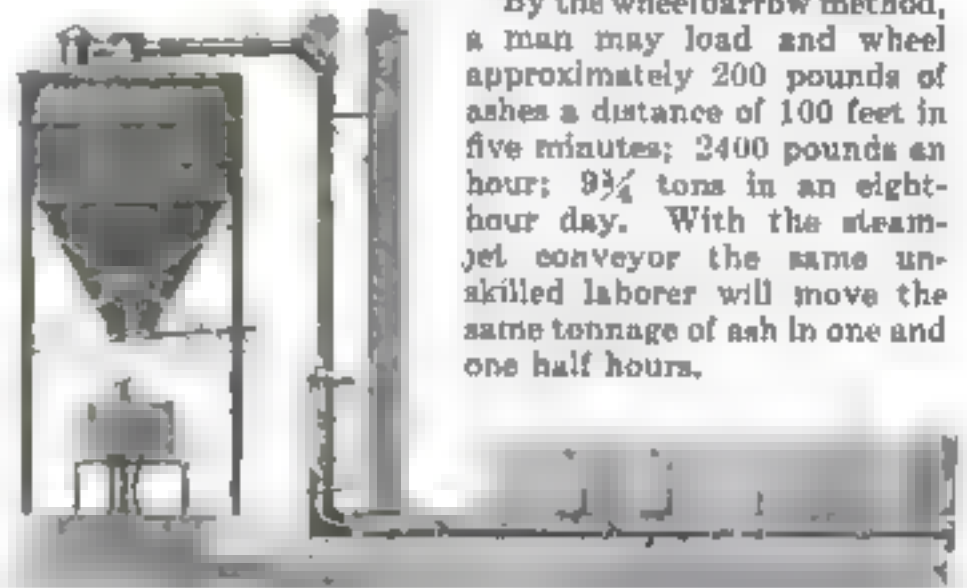
Then in 1895 the legislature of the state protected beavers by law, and a few years later their homes and dams as well.

Removing Ashes with Steam

A STREAM of steam, moving with sufficient velocity, will carry considerable solid matter along with it. In this respect it acts exactly like air. An ash-conveyor that is nothing more nor less than a heavy pipe with steam flowing through it, is now in use. This pipe runs under the ash-pits, and the ashes are dumped directly into this. The steam, traveling at high velocity, whisks the ashes away, carrying them to a hopper outside. The ashes are emptied from the hopper directly into the trucks that carry them away.

This is a quick, dustless, inexpensive operation. Ashes are very abrasive, and machinery used to handle them does not last long.

By the wheelbarrow method, a man may load and wheel approximately 200 pounds of ashes a distance of 100 feet in five minutes; 2400 pounds an hour; $9\frac{3}{4}$ tons in an eight-hour day. With the steam-jet conveyor the same unskilled laborer will move the same tonnage of ash in one and one half hours.



A steam pipe passes under the ash-pits and the steam carries away the ashes, depositing them in a hopper outside the boiler room.

As Substantial as the Pyramids

NOTHING is more unsightly than a huge structure of corrugated iron. At Ishpeming, Michigan, there were two such monstrosities in the shape of shaft-houses belonging to an iron company, and their appearance became worse and worse, until it was very plain that something must be done about it.

Work had to be continued while reconstruction was going on.

It was decided that the best way to accomplish the reform was by concreting the shafts. The concreting started in the summer, but cold weather set in before it was completed, and the sand and cement had to be heated before it was poured. Then the forms were allowed to stand until spring.

The result was entirely satisfactory. The two shafts, which are located conspicuously on a hill, at a distance strangely resemble the Pyramids. Head-frames of this character are more cheaply constructed than are steel frames, and the upkeep is comparatively low. There are no bolts to be kept tight and of course no painting is necessary.



After concreting a corrugated iron shaft-house of an iron mine of the hematite class.

What Is Johnny Coulon's Secret?

All the strong men of France have tried in vain to lift him

JOHNNY COULON is still an unsolved mystery. When he wills it, not "all the king's men" can lift him from the ground—and he weighs only one hundred and eight pounds.

These are the regulations that Johnny demands before he will allow a strong man to tackle him: the strong man must face him, stand at arm's length, and then take hold of him above the hips and yet below the ribs. Johnny, in the meantime, stands firmly and erect on the floor, and places one or two fingers of his right hand on the left side of his opponent's neck over the carotid artery; with his left hand he touches the pulse of his opponent's right hand.

Can he be lifted? Not by the very strongest man in France—unless he wishes it. Then, without visibly moving or changing his position in the least, he allows himself to be lifted high in the air.

Is the cause of this strange power psychical or physical? Physicians, scientists, and psychoanalysts have watched Johnny repeat this performance in Paris until his sides have become painfully bruised and grazed; his doctor has ordered him to stop. And still they do not understand him. Coulon himself says that by his contact he attracts a certain nerve fluid that makes his opponent powerless. The learned men who are studying the problem do not believe this.

All kinds of experiments have been conducted in an effort to solve the mystery. Thinking that perhaps the center of gravity of either Coulon or



Johnny Coulon puts the fingers of his right hand on his opponent's neck near the carotid artery and touches with his left hand the man's right wrist pulse, and remains immovable

his opponent was displaced, Professor Charles Nordmann asked Coulon to remove his fingers from his opponent's neck and to lean first backward and then forward. In both cases he was easily lifted.

Next a chain of three men tackled him. Coulon touched the first and third on the neck and pulse, while the middle man tried to lift him. Both

men touched the middle man on the wrist—but Johnny could not be moved. Yet, when Coulon placed his fingers on the neck and pulse of a strong man who attempted to lift a man other than Coulon, he had no power over the strong man.

There were found to be several conditions under which Coulon's power diminished—if his fingers were wet, if his feet were not flat on the floor, or if a piece of paper were placed between Coulon's fingers and his opponent's neck and wrist.

Professor Nordmann finally came to the conclusion that Coulon exerts some physiological and psychological force. It is not like an electric current or like any other force known to physiologists.

When Houdini, the great American strong man, was asked what he thought of the Coulon stunt, he said fervently: "It's hokum!" He claims that Coulon is playing tricks on the French scientists. "It's the principle of the fulcrum," said he; "a matter of leverage." Coulon is in stable equilibrium and his subject isn't. Coulon keeps his subject at arm's length to get the best advantage of the leverage. "Furthermore," says Houdini heatedly, "the trick has been played before."

This is true. There was Lulu Hurst, and then Annie Abbot. Both of them were vaudeville performers who did the same thing. Miss Abbot, we find, weighed ninety-three pounds, yet she challenged the men in her audiences to lift her.

How Music Is Produced from a Saw

GO to the tool-box and get your saw. Perhaps it is a musical one! And there is no sound sweeter than that which can be drawn from the right kind of saw. How do you play it? Ford Hanford, the man who discovered the saw's musical powers, tells us its secrets.

When he wishes to play, he sits down, crosses his legs, and places the handle end of the saw between them. With his left hand he firmly grasps the outer end of the saw, so that he is able to bend it at will. Next he gives the saw a sharp blow with a felt-covered hammer—and then the music starts. The blow makes the saw vibrate with a tone that suggests that of a tuning-fork. By bending the saw and changing the curvature, he produces other tones after a blow has been struck and the saw is still vibrating. As long as the original vibration lasts he is able to play a phrase by bending the saw



By holding the ends of the saw firmly and hitting it a sharp blow with a felt hammer, vibrations result that cause the saw to pour forth music

into different positions. It took hours of practice to obtain satisfactory tones.

He sits on the stage of a New York theater and, with his partner, Mr. Myers, thrills the audience that listen to the "Greenwich Village Folies." The saw he uses was not specially made; he selected it in a hardware store after trying out several of them. The music it gives is loud enough to reach every corner of the theater.

A bass viol bow well reined, Mr. Hanford finds, will produce even better music than the hammer. He draws it swiftly across the smooth edge of the saw, repeating the process whenever the vibrations die down. The incredulous think that Mr. Hanford produces the music by means of an instrument placed in his mouth. He has perfect control over the saw, but says that his left hand soon becomes tired because of the strain to which it is subjected.

Revolutionizing the Glass-Blowing Industry

The change from lung power to machine in the ancient art of glass-making reads like a romance

By Raymond Francis Yates

IN 1894 a man stood on a chair with a glass-blower's pipe in his hands, the lower end of which rested in a bowl of molten glass. He was trying to prove to a second man that glass-blowing by machine was possible. As he blew into the cold end of the pipe, he lifted it, causing a cylindrically shaped bubble to form at the opposite end. The other man promised to supply the money necessary to develop the machine. An industrial romance had its birth.

John Lubbers was the man on the chair. He showed the world how to make window-glass by machine. He created a new art from the hopeless debris of an old one—that of producing glass by hand and lung. James A. Chambers, president of a glass company, was the man who had faith in Lubbers' ideas. Before Chambers met Lubbers he had made a comfortable fortune in the glass business. He was the first man to introduce the Belgian tank glass furnace into the United States.

Lubbers was a glass-flattener by trade and an experimenter of the most persevering type. Some people would call him a genius. The simple truth is that he worked, worked, worked. He was so obsessed with his idea—that of manufacturing window-glass by machine—that he did not have time to think about failure.

Making Window-Glass the Old Way

The history of making window-glass has no authentic beginning. The yellow pages of a book published in 1649 tell how the art was practiced before that date. There were few changes made during the passing centuries. It remained for John Lubbers to blaze the new trail.

In the old process of blowing window-glass cylinders by hand, the worker takes a long wrought-iron pipe with a bell-shaped opening at one end and a plastic mass of hot glass attached to it. He blows with his mouth into the opposite end of the pipe, and by careful manipulation causes a glass cylinder to form. By reheating this glass bubble and continuing the blowing, a cylinder is finally produced that may be as long as seventy inches with a diameter of twenty inches. When the cylinder has cooled, it is broken away from the pipe, and a crack is produced along its entire length, so that it will flatten out when it is placed in a suitably heated furnace. Cooling, polishing, and a few other minor operations bring the flattened

glass to a marketable condition. This is the old process.

By this time, probably, you have figured out a method of blowing glass cylinders by machine. Just attach an air-pump to the end of the pipe and blow the glass bubble by compressed air. Why didn't somebody think of this before? The fact is, many people had thought of it before, but they did not realize the obstacles that stood in the way.

When Lubbers stood on the chair showing James Chambers how glass cylinders could be blown by machine, he promised to be doing it in this way within three months' time. Ten years later he had assembled a machine that gave some promise of success. By that time nearly three million dollars had been spent in experimenting.

A powerful union of glass-blowers at one time controlled glass manufacture in this country. They dictated their hours, wages, and output. Their organization was so strong that no one could learn the trade unless he had a relative who was in the work.

The glass-blowers' union heard of Lubbers' work. His life was in constant danger. But Lubbers was not a coward, and he vowed that the union should not stand in the path of progress.

James Chambers formed a company to carry on the experimental work. John Lubbers, the uneducated glass-flattener, rolled up his sleeves and went to work on one of the most perplexing problems that has ever engaged an inventor. He little realized what faced him; nor did Chambers know that it was going to lead him to financial ruin. Their greatest asset was faith.

An experimental plant was built at Allegheny, Pennsylvania. Lubbers was in his glory—he was striking into the unknown with nothing to guide him. Three months slipped by. Then six months. His promise of success within three months came to nothing.

The first machine was crude. The ordinary glass-blowing pipe was employed. This was hung vertically over a pot containing the molten glass, and at the upper end of the pipe a hose was attached through which a stream of low-pressure air was forced. The pipe traveled slowly upward as the glass cylinder became larger.

Commercially, this machine was absolutely impossible. It was found that cylinders could not be blown any larger by this method than by hand

and mouth, and those that were blown were worthless. They were thick on one side and thin on the other. Cooling strains also developed in the glass as it passed from the liquid to the solid state, so that it was abnormally brittle. The outer surface of the glass, which was in contact with the air, would cool by radiation before the inside had set. This hard crust of glass on the outside prevented the natural process of expansion when the inside cooled, causing molecular strain that made the glass very sensitive.

The cylinders were not only blown "thick and thin," but they were also blown in a corrugated fashion. There was a breathing effect within the cylinder that caused this; but at the time that was not known.

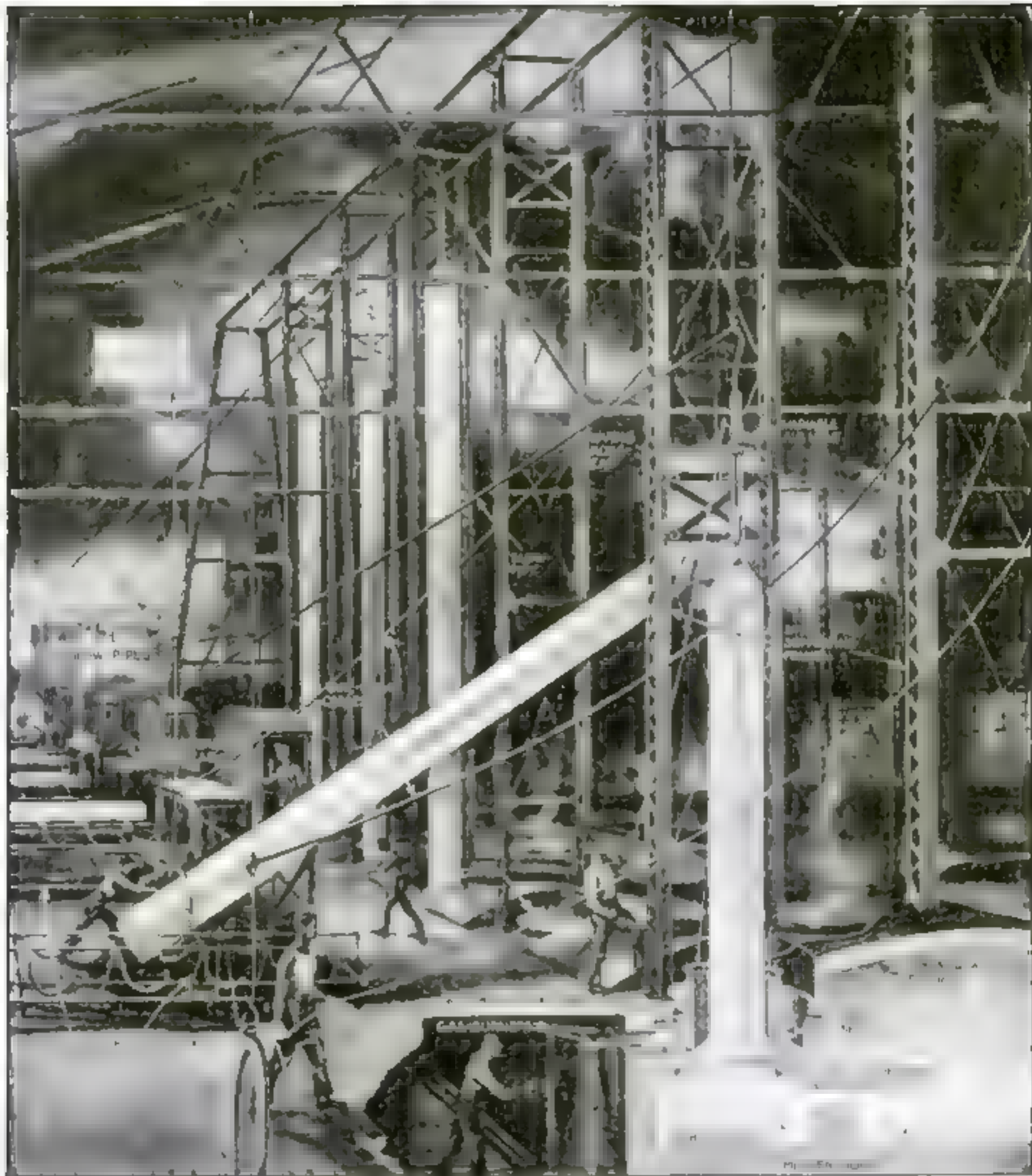
Poor Lubbers was beset with many other discouraging difficulties. Taking care of the glass that remained in the pot after drawing a cylinder was a baffling problem. The bath of glass had to be melted to a perfectly uniform temperature before it could be drawn successfully. To remelt the glass in the pot took time.

The Patience of Job

Lubbers was a patient man. One by one, he overcame the obstacles. Little by little, his experiments pointed out the right path. It was found that the air forced into the cylinder had to be kept at a uniform pressure. A small hand-valve was fitted to the apparatus, and the air supply was gradually regulated as the cylinder was drawn. The results of this makeshift were lamentably bad. Valves of every type were used, but the regulation was entirely too coarse. Finally an automatic valve was developed that effectively increased the pressure of the air as the cylinder became larger.

The corrugations remained in the cylinders despite the perfect regulation of the air. Lubbers, who was not a scientific man, could not determine the cause. After six years of experiment, the mystery remained unsolved. Lubbers placed a vent-hole in the closed-air system, so that the excess air could escape. This was a master stroke; it worked like a charm. The corrugations were entirely eliminated. The art of blowing window-glass by machine was brought from a bare possibility to a fairly practical stage.

By the use of a suitable shield, which protected the glass bath, and a small refractory ring that floated on the surface and through which the glass



After Centuries Glass Is Now Blown by Machine

This is the interior of a modern window-glass factory. Here great glass cylinders are blown by compressed air. The molten glass is held in a reversible refractory pot that is heated by a gas flame. This pot is filled with glass from a "tank furnace." The blow pipe is lowered into the molten glass contained in the pot and a carefully regulated supply of compressed air is then admitted to the pipe while it is slowly raised.

As the pipe travels upward, a glass cylinder is gradually formed. A variable air vent maintains the proper ratio between the volume of compressed air admitted and the

growth of the cylinder. This regulation is absolutely necessary to produce a cylinder of uniform thickness and diameter. As the glass cylinder moves upward, it is exposed to the outside atmosphere and it "sets."

After the cylinder is completely drawn, it is broken from the blow-pipe and hauled down. It is then cut into short lengths with an electrically heated wire and the lengths are placed in the flattening furnace after they are split from end to end. In the flattening furnace, the glass cylinders flatten out into a big sheet of window-glass, which is later cut up into the standard sizes.



In the older process of window glass manufacture, glass blowers place a "bat" on the end of a blow pipe and by blowing with the mouth they produce a cylinder about four feet long. This work is so slow that the cylinder must be reheated several times before it reaches maximum size.

was drawn, the process was brought another step toward success.

Chambers exhausted himself financially. He had spent two hundred and fifty thousand dollars, and at this time called in some business associates. The work went on until 1901. At the end of this period a million dollars had been invested. Were the experimenters discouraged? Not at all. They decided to discontinue the experiments at Allegheny, and lease a larger plant at Alexandria, Indiana, where the work would be carried on approximately a commercial scale.

Success Slowly Approaches

It was at this time that Lubbers found it necessary to give three different speeds to the upward travel of the crosshead that carried the blow-pipe. In blowing larger cylinders, the glass at the bottom started to cool appreciably at the end of the draw. To compensate for this, three different speeds were used, so that a cylinder of uniform longitudinal thickness would be produced.

The speed was finally brought under control by the employment of a magnetic clutch on the hoist that lifted the crosshead.

But the struggle was not yet over. Thick and thin cylinders were still being drawn, and no one knew why. The time required between the drawing of cylinders was too great, and the process could not be brought to a

commercial basis until this difficulty was eliminated.

One of Lubbers' helpers, a man named Thornburg, invented and patented what has become known as a "double reversible pot." This was really two pots arranged back to back, just as if we put two dishpans together, bottom to bottom. Molten glass was ladled into the upper pot, and the cylinder drawn; then the pot was turned over and fresh glass ladled into the upper one, while the one previously used was exposed to the heat of the furnace underneath. In this way the glass left in the pot after a draw was completely melted out and the operation made continuous.

In 1903 it was decided to abandon the plant at Alexandria and start anew at Gas City, Pennsylvania.

After Chambers had spent his last dollar in the work, a powerful combination of glass manufacturers took control. The experiments were carried on as secretly as possible, but members of the glass union heard of them. Realizing that their control of the industry was jeopardized, they left their jobs and went into the employ of companies that were not financing the new process.

The glass combination did not close down its new plant. They went ahead and installed machines that were producing 80 per cent waste! Sheer industrial bullheadedness. A number of plants were equipped with 20 per cent efficient machines, and the work went

on. Lubbers ate, slept, and thought in the glass plant.

Like Pouring Money Down a Hole

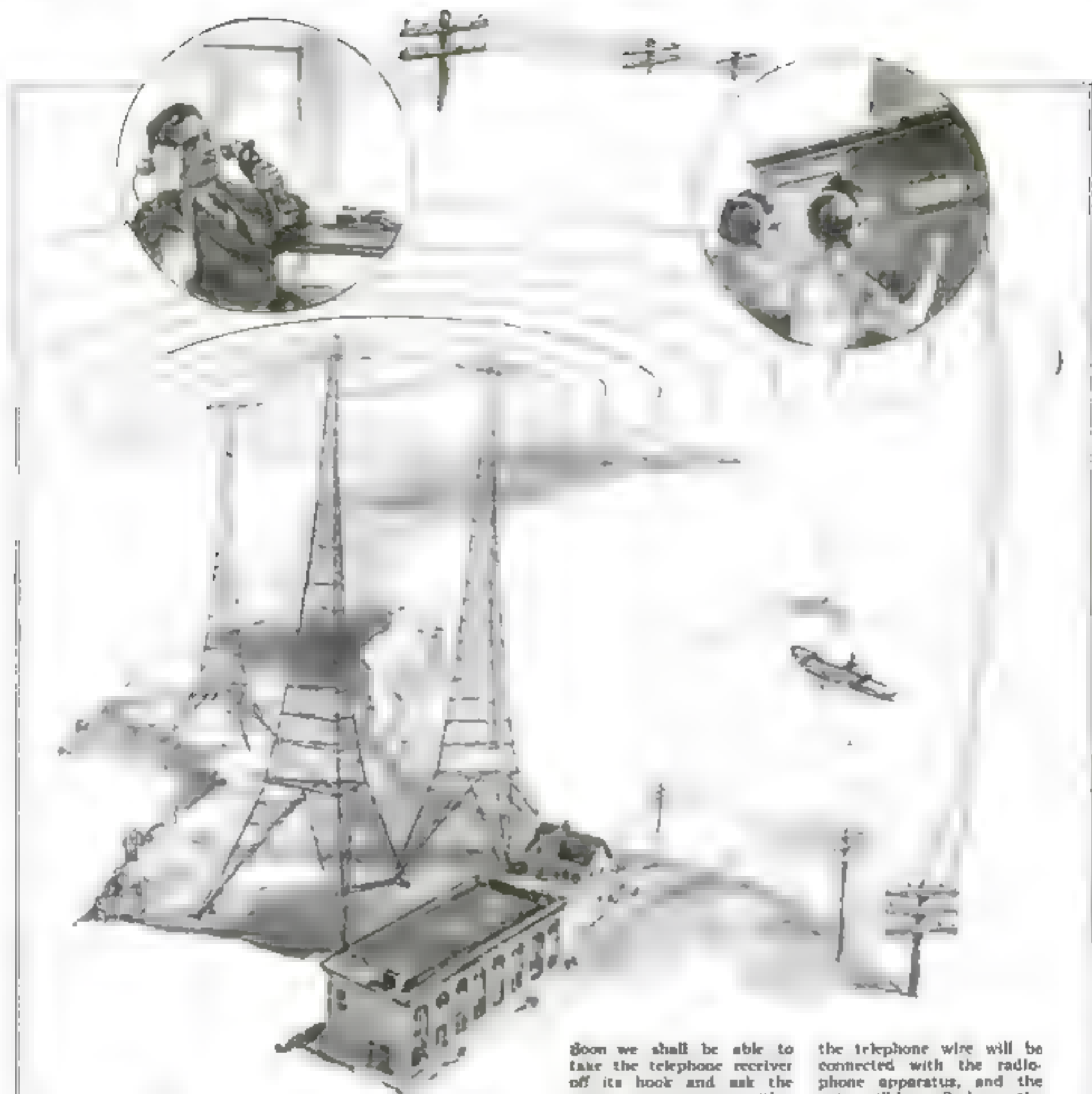
Two or three thousand dollars were lost every day. One veteran glass manufacturer, whose investments ran into the hundreds of thousands, declared he would sell his interest for a square meal.

Lubbers was almost at his wit's end. Perfect cylinders were drawn merely by chance.

The real trouble was a difference in surface tension brought about by slightly different temperatures in various parts of the bath. Lubbers knew nothing about surface tension. He had a watchful eye, however, and noticed that the cylinder usually traveled over the surface of the bath as it was being drawn. He finally hit upon the simple idea of initially adjusting the bait to the one side of the bath in the opposite direction to that in which the cylinder was traveling. The impossible happened. A succession of perfect cylinders was drawn.

Lubbers had conquered. Development work went on rapidly. In 1906 the glass combination actually began to make money. Its books showed a net profit of forty thousand dollars. Today two thirds of the glass manufactured is made by machine.

Cylinders blown by hand reach seventy inches; blown by machine they reach forty feet!

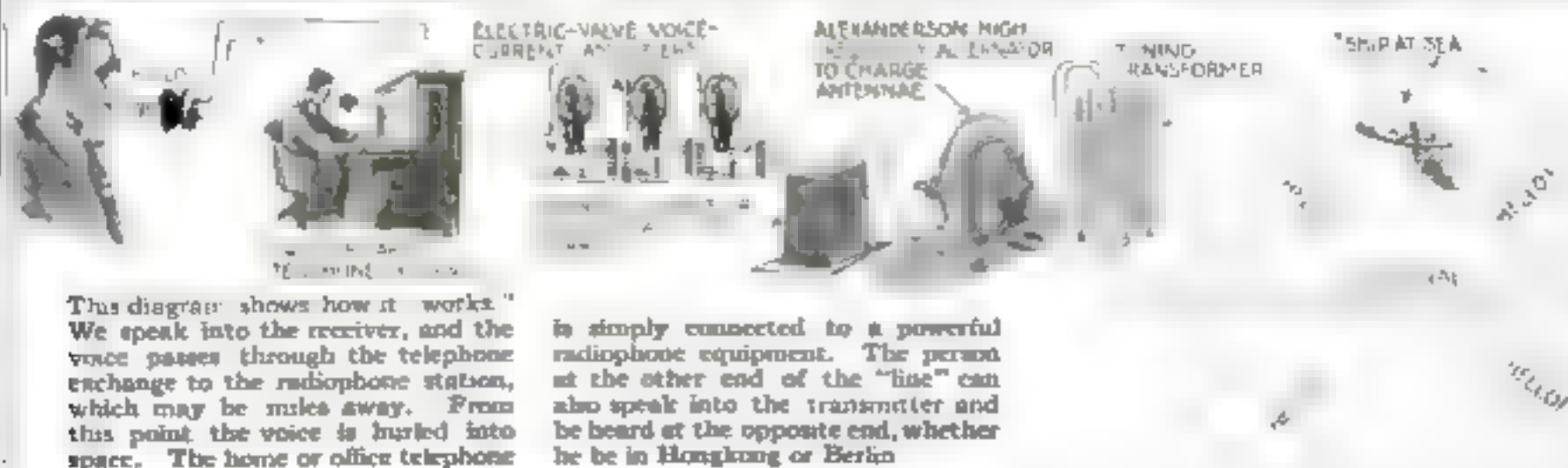


"Hello, Central! Give Me the Mauretania"

Soon we shall be able to take the telephone receiver off its hook and ask the operator to connect us with a ship halfway across the ocean. When this is possible, the operator will connect your telephone with a powerful radiotelephone station. At the radiotelephone station

the telephone wire will be connected with the radiophone apparatus, and the voice will be wafted over the seven seas.

On board the ship, another radiophone station picks up the message, and routes it through to the friend with whom you wish to speak.





Catching the Eye to Advertise Hair-Cuts

HERE is a new adaptation of the barbers' ancient sign. A revolving pole of red-and-white-striped glass containing electric lights is reflected in a number of oblong vertical mirrors arranged in a concave curve behind the pole. The invention is that of Peter Zarella, of Boston, Massachusetts, and the optical illusion produced is that of a series of ascending spirals.

Both the top and bottom of the pole and the reflections are cut from view by strips of ground glass. Placed in a window or in a street show-case, such a sign is sure to attract attention. A fifth-horsepower motor supplies the power.

House Delivered by Motor-Truck

"SEND me one of your four-room houses, C. O. D." A strange order, but it is promised that before long you may be giving that very order yourself. A French engineer is now building complete houses, which are placed on wheels and delivered to your lot by motor-truck. An average price for a house is \$935.

There are two floors, connected by a staircase. The four rooms include a kitchen and heating plant. The house is eight feet wide and fifteen feet high. The upper floor can be lowered for traveling, and the house becomes nine and a half feet high. This is achieved by sliding walls.



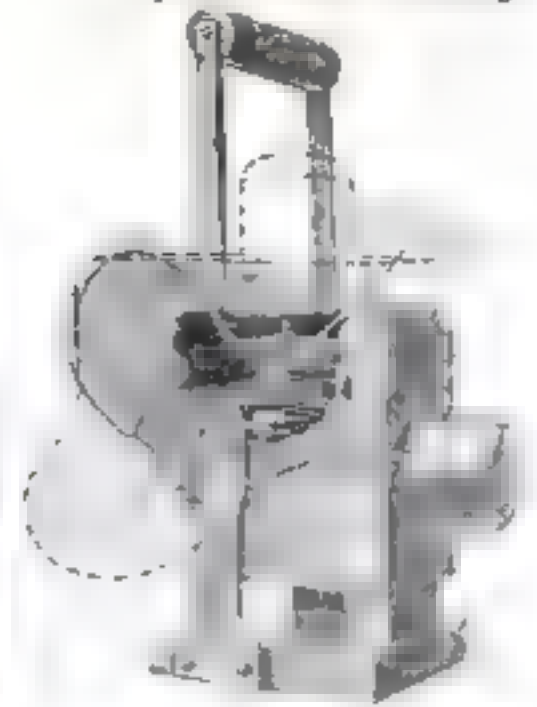
Built on Stilts, It Cast an Unlucky Shadow

AT Soochow, China, an American oil company had a the ground for its building, except for one small square. The owner refused to sell because the building to be erected would cast an "unlucky" shadow on the next lot, which he also owned.

The Yankee manager almost despaired when a Chinese assistant heard of the difficulty. He visited a geomancer—a sort of soothsayer, supposed to interpret the wishes of the natives—and returned with a drawing of a cheap bamboo tower which was put on a spot selected after an entire day spent in pacing and measuring.

No sooner was the structure completed than the owner of the coveted property called on the manager of the oil company and offered to sell.

The reason for the Chinaman's speedy change of mind was that the bamboo tower was so placed as to cast an "unlucky" shadow on the house that occupied the desired lot.



This Battery Works Only When Needed

DRY cells have never been very successful when used in connection with flashlamps. Storage cells are impossible.

A new cell has been perfected that uses lead and zinc elements. It is really a wet battery of radical design, and it is so arranged that the active chemical comes in contact with the plates only when the light is in use.

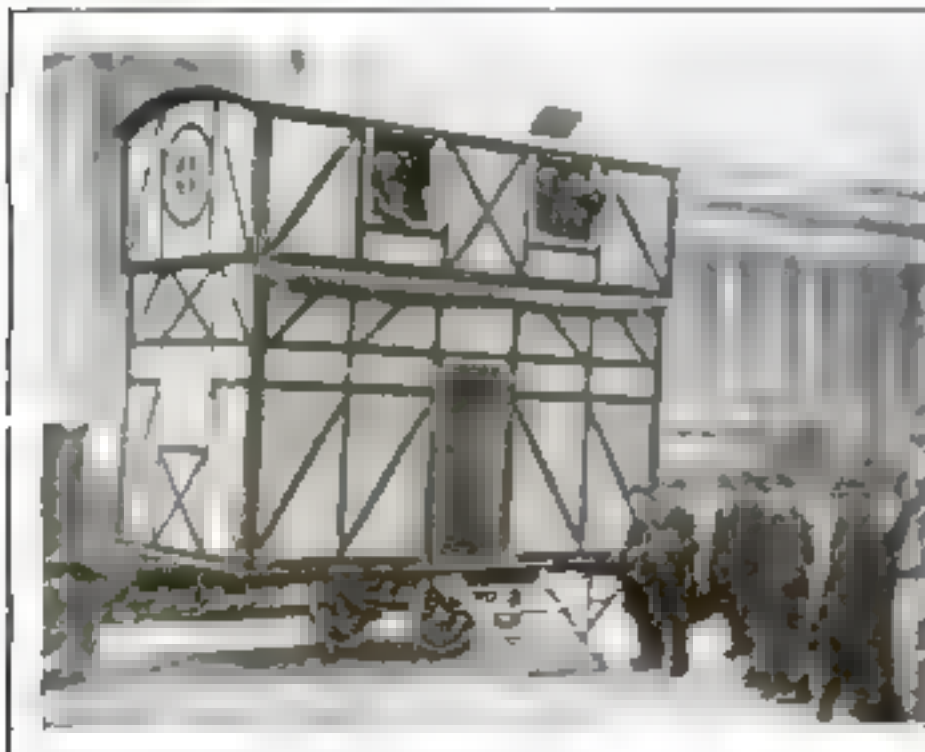
When the light is tipped upward, the electrolyte drains off the plates and runs into a separate chamber, where it remains until the light is tipped back into position. When the electrolyte reaches the plates of the battery, current is generated.

When a Ship Runs on the Rocks

ONLY battleships are built to withstand the test that the *Scarpa*, shown below, is called upon to withstand. It is not a deliberate test of stanchness. The *Scarpa* ran on the rocks off the coast of Ireland.

Like most merchant steamers, only about half an inch of steel plating constitutes the *Scarpa's* hull. It is easy for the waves to pound her against the rocks and to puncture her plating.

A battleship is built with more than one hull, one inside of the other, not to mention a honeycomb of cells in the bottom. It would not pay to build merchant ships in the same way.





He Rounds Up Steers on a Motorcycle

AT the "round-up" in a "bull-dogging" contest at Mason City, Iowa, a motorcycle won the honors of the day.

The object of the game is to catch the steer by the horns and twist his neck until he falls, then quickly tie him before he has a chance to get up. The tandem motorcycle far outdistanced the cowboys on ponies in the contest.

During Jim Lynch, a cowboy riding tandem with S. J. Snyder, who was driving the machine, performed the dangerous feat. When the steer was running neck to neck with the riders, the cowboy sprang upon him and seized his long horns, quickly throwing the animal.



Here's the Giant Among All the Pencils

SOMETHING different—that's what many actresses hunt for. One of them decided to own the largest usable pencil that she could have made. Here it is. It measures twenty-six inches in length and one inch in diameter. There is a real eraser at the end and real lead throughout.

The lead is made from a graphite compound similar to that used in drawing-pencils. It was hydraulically forced through a special sapphire die and came out in the form of a shoe-string. It was straightened and dried, during which process it was subjected to a heat of two thousand degrees.

Graphite, from which pencils are made, is imported from Mexico and Ceylon.

A Snake-Charmer's Secret

HOW does the snake-charmer charm? That's one of the questions we've always asked ourselves. And now an English doctor tells us one of the secrets.

Take the case of the cobra, for instance. It is a very venomous snake, yet the snake-charmer is not harmed when bitten by one.

The secret lies in the fact that the charmer "mills" the cobra before he allows himself to be bitten. He makes the cobra bite into a piece of meat, thereby expelling two thirds of the poison in its poison gland. When the charmer allows the snake to bite him immediately thereafter, there is not enough poison left in the gland to do any harm.

What is the next step? The charmer makes the snake bite a fowl while he squeezes the remaining drops of poison out of the snake's gland, the fowl dies, and the charmer wins the confidence of his audience.

Protecting a New Road from Sun and Rain

NEWLY poured concrete must be protected from the sun and rain. The sun causes it to dry out too rapidly, and this is liable to produce cracks. The rain washes the fresh concrete away.

To protect a newly built road, the road-builders first lay canvas on the surface. This is to keep the rain off. A layer of straw is then laid on the canvas. This protects it from the hot sun. The straw is wetted slightly to prevent the road from drying too quickly.

The road is protected in this way as fast as the concrete is poured, so that there is no danger of having to do the work over again.

Taxis Hailed by Slot-Machine

TAXICABS are always hard to find when it is raining. The man in the picture below is dropping a coin into the slot, and in a few moments a cab will rush up to the curb for him.

This is the new way of calling taxicabs in Germany. When the coin is dropped into the slot, an electric circuit is closed and a lamp flashes at the taxi headquarters. This lamp tells just where the waiting person is, and a cab is despatched to the location.

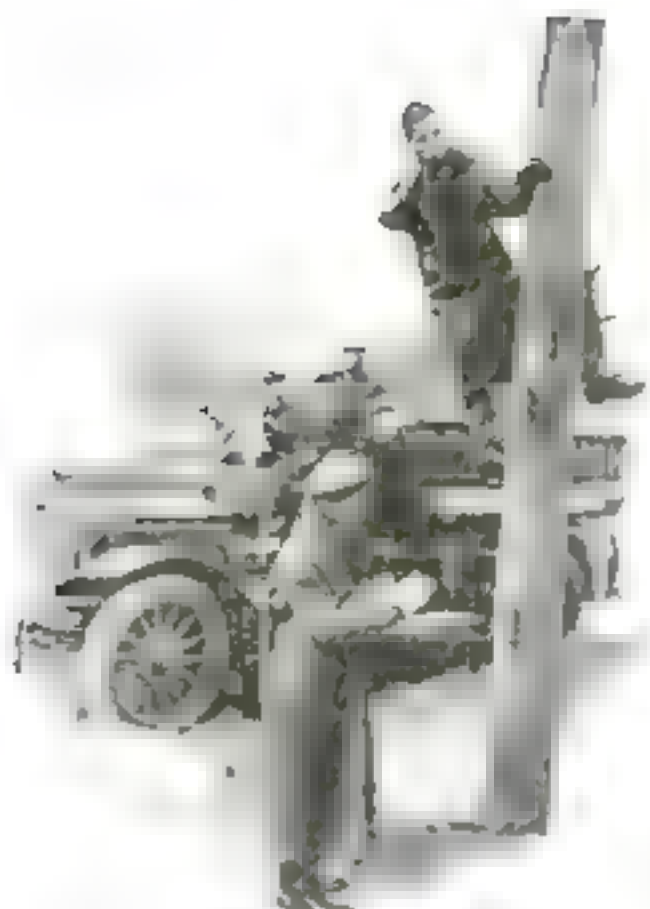
Machine-Oil that Sells Itself

IN spite of so-called "crime waves," store-keepers grow more trusting every day. One of them—he sells sewing-machines and accessories—permits his customers to wait on themselves at the "machine-oil" counter. They select their bottles of oil and then drop the proper amount of money through a slot; it lands in a locked drawer.

The oil counter is a converted dresser, and it stands conspicuously in front of the store.

The bottles of oil are arranged across the top, as shown in the picture, and the coin-box with its slot is located in the center.





He Is Telephoning from the Pole

IT is now easy for fire departments to telephone from the fire-engine in the midst of fighting a blaze.

The fire department at Glassboro, New Jersey, has a lineman on its crew who has rigged up a device that can be used wherever there are overhead telephone-wires.

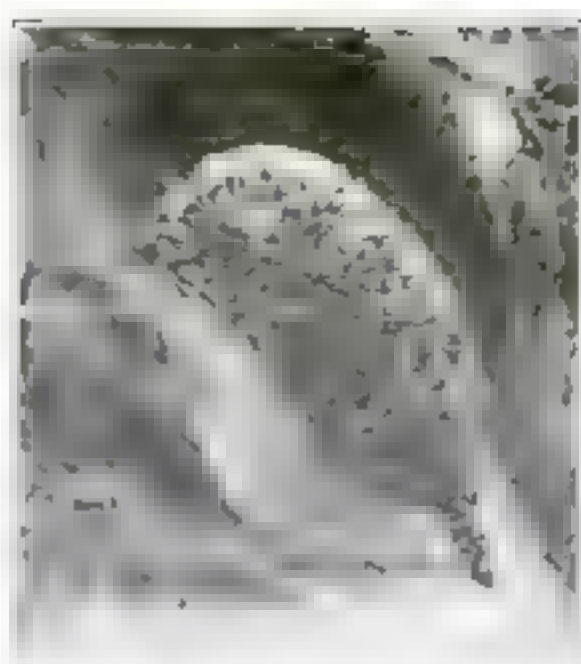
The equipment consists of a double length of covered telephone wire, about fifty feet long, with clasps at one end for hooking to the wires, and a portable telephone at the other end. When the fire crew gets out of reach of the regular telephones, all they do is climb the nearest pole and hook on the connection.

To Hear the Baby Cry

PARENTS vary in regard to the treatment of a crying baby. Some let the baby cry; others rush to pick him up.

A father belonging to the latter class worried considerably because he could not hear his child cry at night. The child slept a distance from the father's room.

What did the father do? He had three loud-speaking telephone transmitters installed over the baby's crib and a receiver placed over his own bed!



Euphorbia—the Porcupine Plant

A VERY singular desert plant has recently been discovered in British East Africa. It is known to botanists as *Euphorbia esula*, and often exhibits a most remarkable habit of growth.

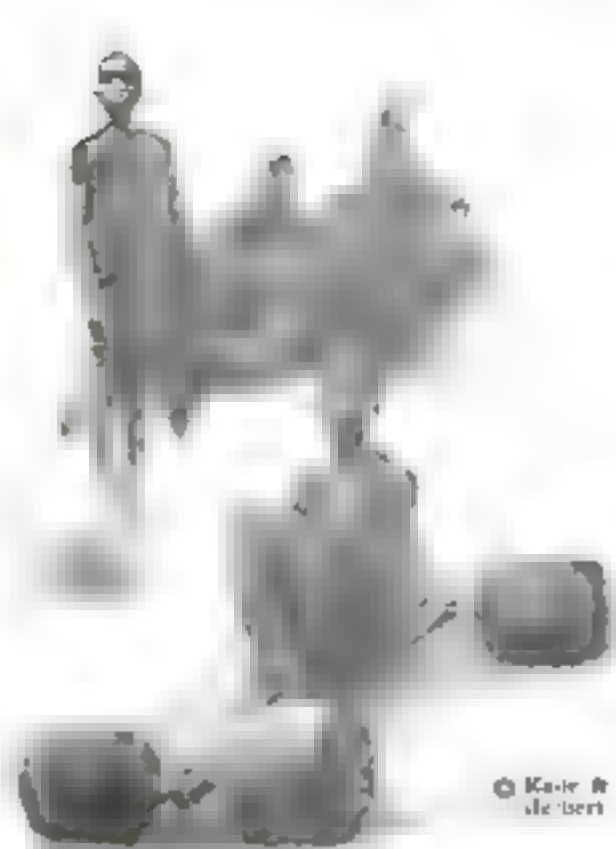
Like so many other plants that thrive in dry locations, this euphorbia produces long spines that practically cover it. Hence the plant bears an astonishing resemblance to a porcupine. Indeed, a traveler coming suddenly upon the plant, finds it difficult to believe that he is not looking at one of these animals crouching between the rocks.

There are many other instances in which plants and animals resemble each other. The butterfly, for instance, often has the same coloring as the flowers among which it lives. Thus nature protects it from attack.

No More Trains Will Pass Over This Bridge

THE last train has passed over this bridge. Engineers have warned that it is unsafe. It is a unique bridge, too. There is not another like it in the world. More than 3,800,000 feet of lumber was used in its construction. It stretches across a valley that is thirty-two hundred feet long. The bridge is 118 feet high. It is situated near Camrose, Alberta, Canada.

Wooden trestles are out of date and unsafe. The rolling stock of the railroads is becoming too heavy for the old wooden trestles. Steel is now considered the best trestle-building material. Long ago it replaced wood.



"Scooting" Among the Natives in South Africa

WHO invented the wheel? Probably some caveman. At least, history does not record the date.

The wheel was probably invented all over again, as far as this black boy is concerned, when he used his ingenuity to make a scooter for himself.

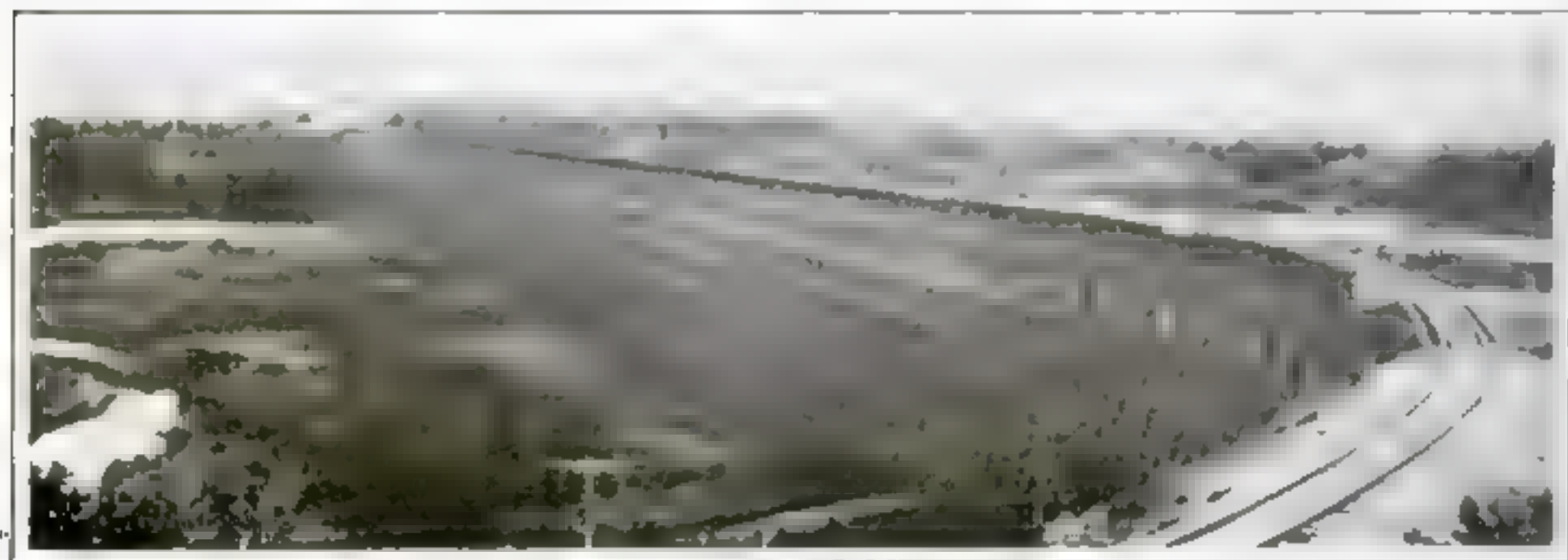
He baked clay in earthen pots, first placing the bamboo "axles" in the center. The wheels were then attached to two bamboo rods and the first South African scooter had its birth.

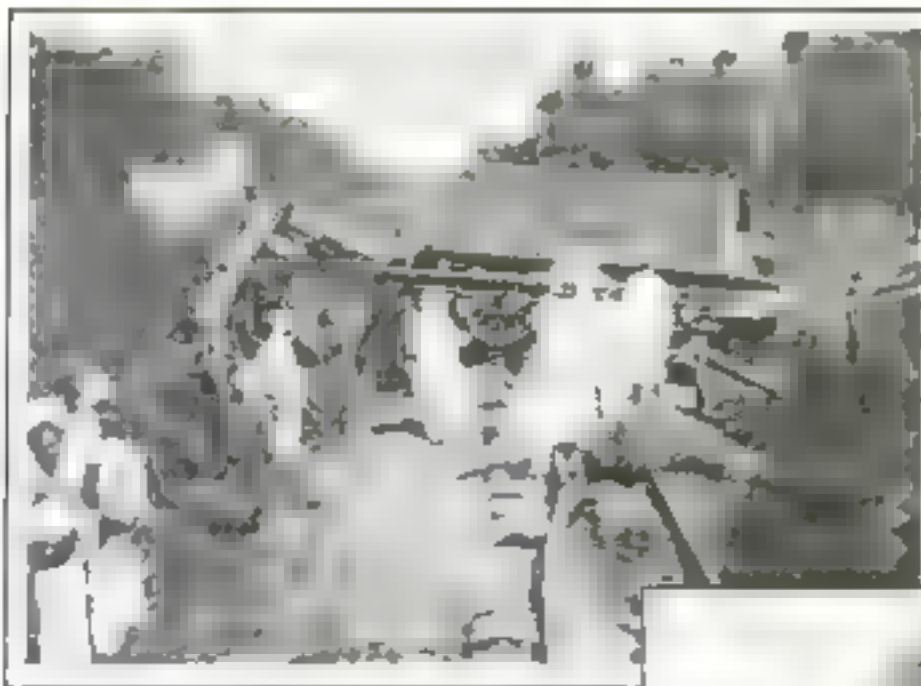
Above you see its dark little owner on his way down a hill. He deserves a lot of credit, for he is a real inventor.

Canned Tennis-Balls

DEAD tennis-balls are worse than useless. What makes a ball go dead? Atmospheric conditions vary often. However, if tennis-balls are canned hermetically sealed, when manufactured, they will be as good as new when opened.

This has been done recently in shipping tennis-balls to China. Heretofore the balls have lost much of their resiliency because of the long ocean voyage. But now, they are not affected by the journey.





What Wrecked This Jungle Train?

RECENTLY, in Indo-China, not far from Saigon, a big-game hunter had wounded a large bull elephant, which he was going to follow up. The beast came upon the railway where it passed through the jungle, and, scenting the approach of a train, charged down the track to meet it. A bend hid the elephant from the engineer until it was too late to avoid a collision.

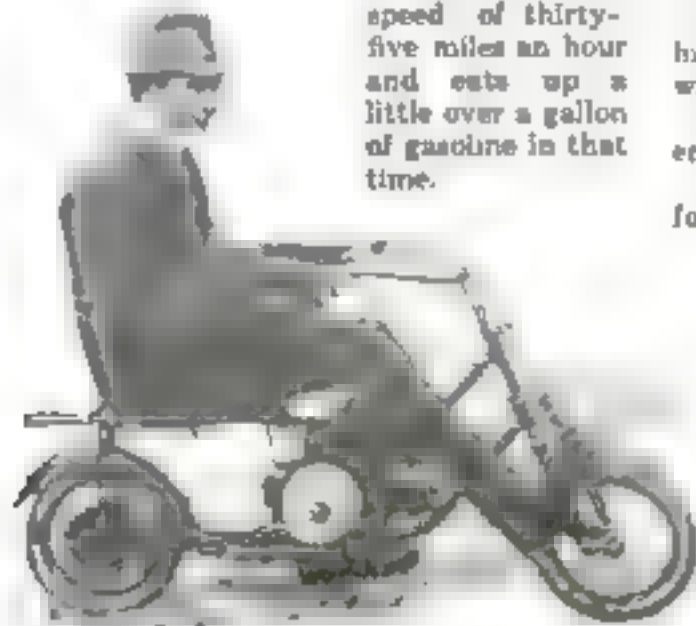
So great was the shock that the engine was thrown completely off the track. It rolled over on its side, and the two foremost cars were also derailed. The engineer and fireman escaped injury by jumping from the cab just before the elephant charged.

Nobody was hurt. The elephant was killed outright.

Comfort and a Motorcycle

THE American user of motor "scooters" is perfectly willing to sacrifice comfort for speed; but not the average Frenchman. He wants to sit on a backed seat instead of a saddle, and he likes to stretch his feet in front of him. The result? His motorcycle is a strange affair. The wheels are very small and the body of the machine is close to the ground. The steering-post slopes toward the rider so that the handlebars are easily within his reach as he sits back in comfort. The result is a motorcycle rather than a scooter.

One of these motorcycles is shown in the picture below. It will attain a speed of thirty-five miles an hour and eats up a little over a gallon of gasoline in that time.



Erected in Memory of a Beloved Elephant

IN the photograph above a tower of unusual design is shown. It stands near the deserted city of Fatehpur Sikri, British India, at one time the capital of the Mogul emperor Akbar, who ruled over a greater part of India from 1556 to 1603.

The structure is known as the *Hiram Minar*, or Deer Tower, and it was erected by the Emperor Akbar in memory of a favorite elephant that died on the spot now occupied by the tower.

The monument is seventy-two feet high and is ornamented on the outside with hundreds of imitation elephant tusks.

It is said to be the only monument erected to an elephant.

It is not unusual, however, for the inhabitants of Eastern countries to do honor to the elephant. In Siam it belongs only to the king. It is baptized, and fetes are given in its honor, and when one dies, it is mourned for, just as we mourn for our loved ones.

In India the natives have a great reverence for the elephant because of its intelligence, which to them seems uncanny.

Iron Pipe All in One Piece

FEW people realize what an important thing welding has grown to be. Today it has a thousand and one uses—all of them of great value to industry.

As yet is a gigantic iron pipe with an elbow that is made in one piece. This was made possible through welding. All the joints of the pipe are carefully welded together, making a single piece. The resulting pipe was so large and unwieldy that it was necessary to be provided for its transportation.

This pipe was planned to be used to help in the canalization of natural streams in Germany.

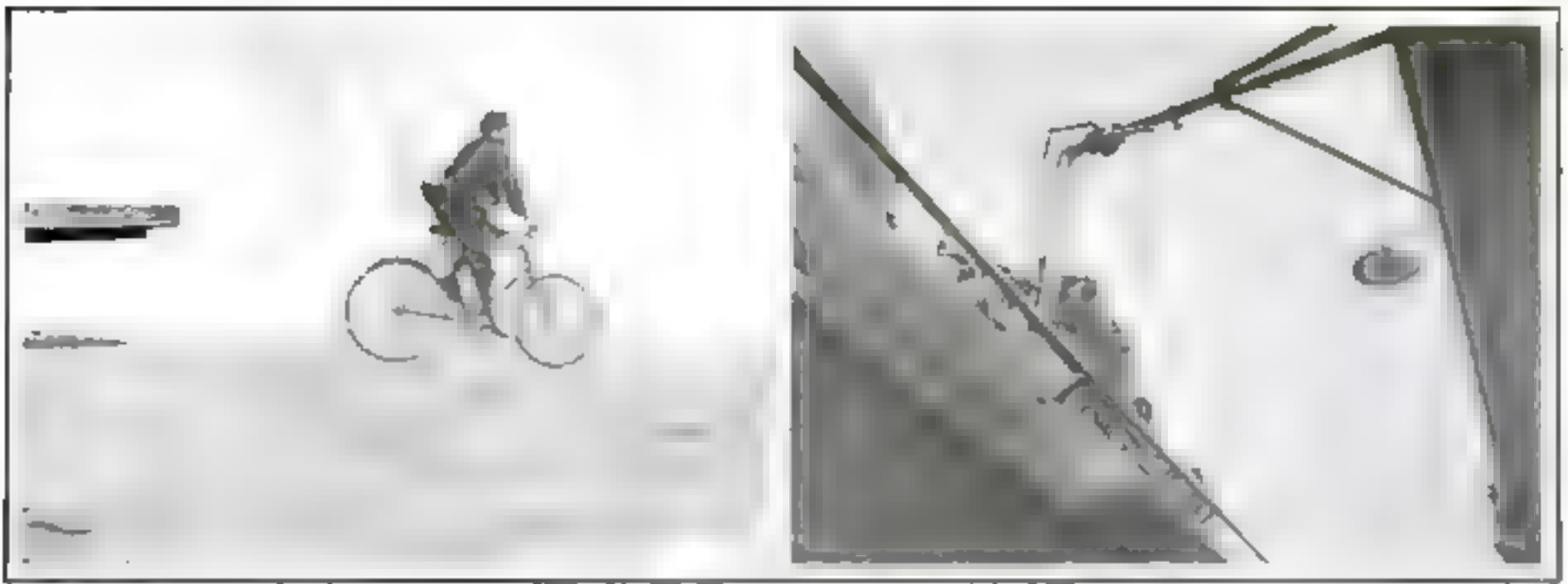
A few years ago the construction of such a large pipe would have been extremely difficult. A pipe like this is now made in a few weeks. Twenty years ago, it would have taken months to turn out such a job.

Four Children at One Desk

SMALL children are interested in each other; they are chummy," says Mr. G. Rankin, a school director of Muhlenberg, Pennsylvania. Whereupon he invents a chummy four, in the form of a desk. It is square, has four legs, and to each leg a swinging stool is attached, which is spring supported and vertically adjustable for different sized children. Thus four children may sit at one desk.

Besides the chummy element, this new desk takes up very little floor space, it is easily cleaned. A class of forty pupils arranged about these table-desks occupied less than three eighths of the space required when single desks were used.





© Keystone View Company

© Keystone View Company

Into the Sea on a Bicycle

BICYCLE riding, like any other sport, becomes monotonous in time. An Italian rider, however, has discovered a way to make it very exciting. He rides along the water-front, and whenever he sees a spring-board that is several feet above the water, he rides right off it, straight for the water!

His bicycle drops through the air, and as it goes he pedals rapidly. Thus, when it hits the water, he is able to keep it from sinking for a few seconds. He wears a life-saving suit, and in a short time he and his bicycle are back on shore, wet but happy.

Ice-Skates Made of Bone

IN the twelfth century steel was unknown. And yet the people of that time skated whenever there was ice.

What were their skates made of? Bone. The leg bones of animals were used. They were tied to the feet by means of thongs, after being properly shaped and sharpened. Since the skaters were not able to make any speed on these skates, poles were used.



Airplane Wings that Fold for Greater Speed

AN airplane is like a kite in this: It needs a wing surface to rise from the ground. Hence all the big weight-carrying machines have large wings. On the other hand, large wings mean air-resistance in flight and a consequent reduction in speed.

Airplane designers knew all this as soon as flying became practicable. They talked of reefing wings—wings that could be partially folded up in flight. Now comes a Frenchman who builds a machine with a wing that can be reduced in area. The big wing consists of three sections. The top and bottom sections can slide to a certain extent over the middle section.

With full wing spread the speed is only thirty-seven miles an hour; with minimum spread, one hundred and twenty-four miles an hour. Grandjean, the French aviator, made the test.

Pumping Sand for the Engine

WE are just learning how to make use of compressed air; every day brings a new application. The railroads are now making use of it in filling the sand domes of their locomotives.

The sand is stored away in an air-tight cylinder in which a pressure is maintained. A pipe carries the sand to the dome, and the locomotive takes on sand in the same way that it takes on water. The fireman places the end of the pipe over the filling hole, opens the valve, and sand rushes in under pressure.

It now takes seconds to fill a sand dome where it used to take minutes.

To Photograph a Movie Battle

NOVEL is the angle of view afforded the moving-picture photographer when he takes to the air. But airplanes are too swift for "close-ups" and so it is necessary to make use of the "blimp."

Marshall Nellan, the director who staged "Custer's Last Fight," found that a gas-bag of 35,000 cubic feet, supplied by 200-pound metal containers, could be profitably employed, even when it required two freight-cars to transport it 2200 miles to the scene of the battle.

From the car of the hump semaphore experts wigwagged the director's instructions to the actors on different parts of the field. In one case the "blimp" traveled slowly over the scene at thirty-five feet from the ground, obtaining "close-ups" of unbroken continuity.



© Kadd & Herbert



Wireless Telegraphy with the Code Left Out

THE learning of the Morse code is tedious. Here is a little automatic sender that obviates the necessity of learning the code. A Frenchman designed this apparatus for use in aerial navigation. The operation of the wireless outfit is reduced to the manipulation of the six keys.

It is by pressing various combinations of these keys that different messages may be sent.

A wind-driven distributor is placed on the front of the airplane. This is a revolving metal disk with proper combinations of dots and dashes mounted on its surface. From this point six electrical circuits run to the keyboard. When one key is pressed, a single dot is sent out, when two keys are pressed, two dots are sent out. The other keys represent dashes. By pressing the proper combination of keys, the code signals may be sent to the ground stations.

This Dentist's Office Travels to the Patient

GERMAN municipalities have always been models of fatherliness. They see to it—at least, they did before the war—that people behave themselves; that the streets are kept clean, that nobody makes night hideous with piano-playing after ten o'clock, and that everybody gets a seat in the street-cars.

Apparently the system is still operating. The city of Dortmund, for example, takes care of children's teeth. To be sure, American cities do that, too, through their boards of health. Dortmund, however, goes farther than we do. It doesn't wait for the children to turn up. It goes to the children with a dentist's office on wheels. There is no escaping the tooth-yanking and tooth-filling process that boys and girls dread.

© Kaul & Herbert

He Fills His Suitcase with Light

A SUITCASE full of incandescent lamps for the photographer's lighting effects is a novelty. A stand supports the open case, and when the socket of the wire is attached to the house circuit a brilliant illumination suitable for photography indoors is obtained.

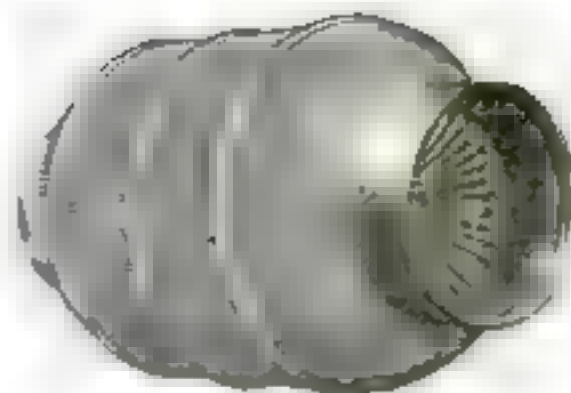
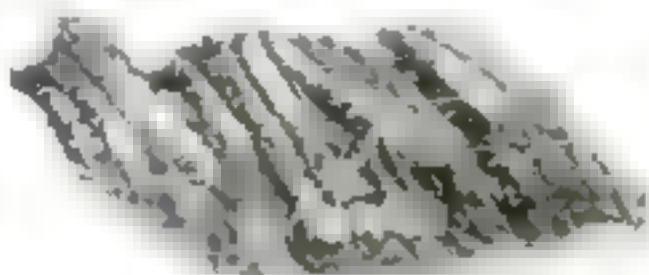
This is particularly convenient for "home photography," where the subjects must be taken amid indoor surroundings, and where the ordinary illumination is usually poor. To prevent a harsh glare of light, a curtain of thin silk crepe is superposed before the lamps.



Chinese Eggs Shipped in Straw

IN America we ship eggs in crates, a very safe and economical way. The Chinese prefer to follow their ancient custom of shipping them in straw. A bird builds its nest of weeds and straw and that protects the eggs, so why not use straw as a means of packing them for shipment? Besides, wood is so scarce in China that wooden crates would be too expensive.

So the Chinaman uses long straw beds, wherein the eggs are placed and separated by braided partitions of straw.



The Airplane Engine Cooled in a New Way

FLAT radiators of the automobile type for airplanes are not the best for the purpose. When the airplane is flying at high speeds, the flat surface offers resistance to the motion. Here is Lambdin's radiator, which is worked out on new lines. This radiator can be placed anywhere. Its cylindrical form has many advantages. For instance, the cooling tubes containing water can be made long, narrow, and flat. The cooling air sweeps rapidly through the open cage-like device from one end to the other.

Hollow tubes of thin sheet metal are used, and they come together at each end in a ring-shaped water-chamber. The water enters the rear chamber by pipe, flows through the different tubes, emerging at the front chamber, which has an offtake pipe. A second set of inwardly projecting tubes is also used. The outer tubes are connected by three small water-tubes that also bind the whole together.

Caging the Corn to Foil the Greedy Rat

CATS, traps, poisons, and "other agents too numerous to mention" have been used to fight the rats that infest corn-cribs and annually consume millions of bushels of corn intended as cattle-feed. Yet, with all this drastic war, the loss of corn due to rats has been increasing rather than diminishing.

Little wonder that farmers are welcoming the "rat-proof corn-crib." It is made with sides of woven steel, a steel roof, steel floor, and steel doors. The crib comes in sections, ready to set up. All the farmer does is to lay a concrete foundation and erect the building on top of it. The crib is absolutely rat-proof, for rats cannot gnaw through steel nor climb up smooth steel surfaces. The crib is also fireproof and the corn keeps better in it.



Across the Atlantic in a Forty-Five-Foot Boat

After looping the North Atlantic, the tiny yacht weathered the worst of the winter's heavy gales

By William Washburn Nutting

OUR cruise in the *Typhoon* from Nova Scotia to England, and back to New York via France, Spain, and the Azores, was made primarily for the fun of the thing. There was no burning scientific conviction to justify it, nor any thought of financial gain. To be sure, there was an international motorboat race at Cowes on the tenth of August, and it was this we took as an objective; but, as far as we were concerned, we needed no excuse other than the one of sport. Picking your course across great stretches of ocean by your own (newly acquired) skill with the sextant pitting your wits against the big honest forces of nature, feeling your way with lead-line, possibly through fog and darkness, into strange places that the travelers of trodden paths never experience—these things, we think, are worth the time, the expense—yes, even the hardship and actual suffering—that are bound to be a part of any such undertaking.

We don't recommend taking chances with the North Atlantic in the middle of November, and we do not recommend crossing on the fiftieth parallel at any time of the year, as we did on our record passage to Cowes; but we hope that the small boat and its possibilities for cruising will come into its own.

Weathering the Gale

It was on the seventeenth of November, the twenty-ninth day from Ponta Delgada, that the big blow came. *Typhoon* had weathered many a gale before in her seven thousand miles at sea—one off the Newfoundland coast, another in the Channel, and a blow near the Azores that sent eight American Shipping Board vessels into port for repairs. And we had just come through a two days' "nor'easter" that we felt was the last word in weather.

On the first day of this blow, running before it under full jib and mizzen, we had overtaken a three-masted schooner hove to, shot by her at fifty yards, photographed her, and left her wallowing astern. On the second day we had received a

knock-down that had put our mast-heads in the water, and, having come through this experience unscathed, our confidence in the design and construction of our little ship was absolute

white. The long, gray, sweeping seas of the day before became confused, irregular, and wickedly unstable.

We were running under storm trisail, a small sail, heavily roped; and, to make steering easier and to check our progress as we shot down the slopes of the seas, we had put out a long line astern. But by mid-afternoon it was apparent that we could not carry even the trisail much longer. I was at the wheel. An occasional crest came over the quarter, flooding the cockpit and filling the slack of the trisail. Our speed was becoming dangerous. We put out a second line on the end of which was a large bucket; but even this failed to retard us sufficiently.

I decided to try the sea-anchor, which we had never yet had occasion to use.

What a Sea-Anchor Is Like

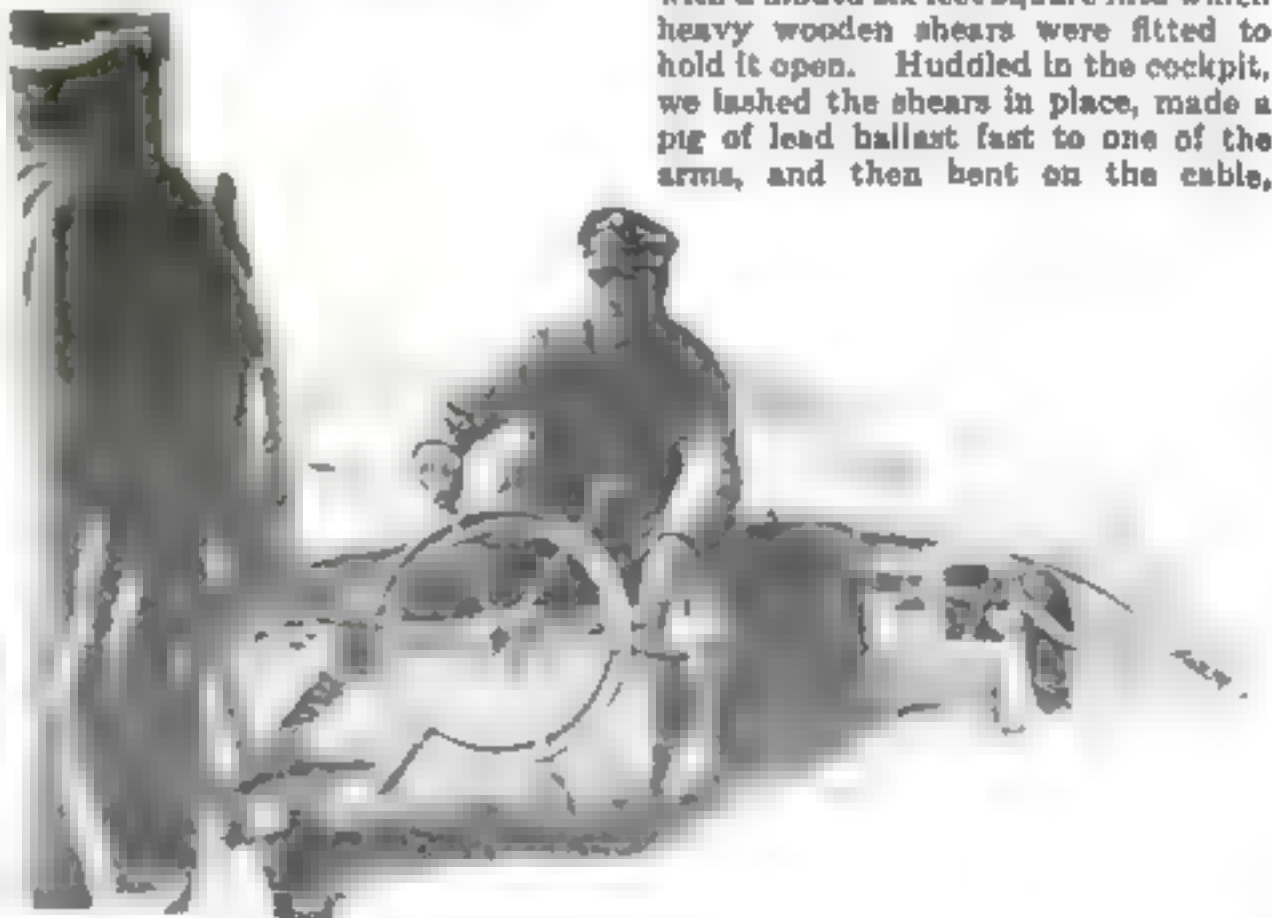
The purpose of this device is to hold the ship's head to the wind when conditions are too severe to carry sail. We brought it up from below, a great canvas bag, pyramid-shaped, with a mouth six feet square into which heavy wooden shears were fitted to hold it open. Huddled in the cockpit, we lashed the shears in place, made a pig of lead ballast fast to one of the arms, and then bent on the cable,

What the Little *Typhoon* Did

Typhoon is a forty-five-foot auxiliary ketch, designed by William Atkin after suggestions by the writer, and built at Alexander Graham Bell's laboratory in Nova Scotia. She sailed for England on the eighteenth of last July, reaching Cowes in twenty-two days. She reached New York in November, after a run of thirty-two days from Ponta Delgada in the Azores, where she had arrived from England via France and Spain.

We felt that the Atlantic could do nothing further. But we were mistaken.

On the morning of the seventeenth, when the temperature indicated that we were drawing out of the Gulf Stream, the wind hauled around to the southwest and blew in a succession of hard punches, increasing in intensity until the sea was a driving mass of



William Washburn Nutting, skipper of the *Typhoon*, the forty-five-foot ketch that last summer made a record trip under sail from Newfoundland to the Scilly Isles in fifteen days

which previously had been led through a fairlead on the end of the bowsprit in order to obtain the extra seven feet of leverage.

When everything was ready, Fox and Dorsett were instructed to put on life-lines and go forward to lower the trisail. Fox had reached the mainmast, to which he clung with arms and legs, and Dorsett had jumped out of the cockpit to join him, when a big sea came over us, jerking away my sou'-wester and burying Fox to his armpits. Dorsett, clinging to the mizzen rigging, shouted, "That was a hell of a big one, skipper!" and started forward again along the waterway. Hooky, embracing the mizzenmast, held the sea-anchor from going overboard by the weight of his body. I crouched in the corner of the cockpit and clung to the wheel. Then the big crash came, and we went down under tons of solid water.

Buried in Water—but Staggers Up

How many seconds we were rolled down, I can't say, but finally the good little ship staggered to her feet again. As the water poured off us, I looked to lee'ard and there, sixty feet away, in an acre of froth, was Jim Dorsett's close-cropped head, his sou'-wester hanging from its string around his neck.

I realized that it was impossible to manuever the yacht in such a sea. It was equally impossible to swim for Jim in sea-boots and heavy oilskins, and there was no time to take them off. Remembering the lines trailing astern, I yelled and gesticulated to Dorsett, who made for them.

Fox also had been washed overboard, but he had regained the ship by way of the mainmast which had come down on top of him. He now lowered the trisail. As we reeled down past Dorsett under bare poles, he managed to seize one of the lines, but it slipped through his grasp. It was an agonizing moment for us on the *Typhoon*, watching him, now under water, now

Jim was overboard! How many seconds we were rolled down, I can't say, but finally the good little ship staggered to her feet again. We could see Jim's close cropped head in an acre of froth, his sou'-wester hanging from its string around his neck.

visible and each time farther from the ship. The line to which he clung was not the one with the bucket, and I feared that every moment he would reach the end; but finally, turning on his back, he was able to hold fast, and we got him in. With the aid of a boat-hook we pried him higher. Then we got a leg over the gunwale and I determined that at least we would have that leg. Finally after more tugging, he was aboard.

The Sea-Anchor Line Parts

Passing Dorsett below, we turned him over to Dillaway, who had been battened down in the cabin through the ordeal, and prepared to throw over the sea-anchor. I had theories about sea-anchors, but I was not at all certain that it would be possible to hold *Typhoon's* high bow to the seas without some bit of sail aft to act as a weather-vane. As a precaution, we had brought out our little spitfire jib, which is mounted on a steel huff-rope, so that in case the sea-anchor proved insuffi-

cient we could hoist it on the mizzen and trim it flat.

Finally we got the bag overboard, but I can't say just how effective it would have been; for as the strain came on the line it parted like a piece of twine and we were left in the trough.

Then I realized that, for the ten minutes or so that had elapsed since the knockdown, *Typhoon* had taken care of herself perfectly in spite of the seas that crashed aboard. So, leaving her to her own devices, we went below, drew the companion hatch, opened a bottle of cognac, sang some songs, and turned in. And came through without mishap. In weathering the blow that delayed the *Aquidania* and wrung the S. O. S. from many a giant ship, *Typhoon* proved that a small boat can be as seaworthy as a big one.



By installing gigantic machinery in railroad yards it is possible to unload grain by the simple operation of tipping

Unload the Car by Tipping

FOUR machines for unloading grain from railroad-cars to grain elevators have been installed in a new Pennsylvania railroad elevator at Baltimore.

An operation that it took four men forty-five minutes to accomplish can now be done in ten minutes by three men.

When a car is hauled into position by a "barney" elevating arrangement, it is clamped in place on a tipping table erected on a cradle. The tipping table tips the car longitudinally, 30 degrees, while the cradle tips it endwise 45 degrees, first one end up and then the other. Another feature of the machine is a "door-opener," which pushes the door of the car, filled to the brim with grain, backward without breaking it, and is equipped with a "hopper" into which the grain drops.

Underneath there are traveling belts that convey the grain into the bins.

Peach-Stones as a Substitute for Coal

PEACH-STONES all during the war we saved our peach-stones and dropped them in barrels that were placed in convenient spots. Some of the stones were subsequently used in making gas-masks. But many tons of them were left over when the war ended. What's to be done with them? Use them for fuel, says the New York Coal Exchange.

Peach-stones have about 80 per cent of the heating value of coal. And they are being sold now at one dollar per ton! With coal both scarce and expensive, it is expected that peach-stones will become very popular. They can be used in the furnace, in the kitchen stove, and in the parlor grate.

One Stove Heats Four Rooms

TO carry a small gas or oil stove is an easy matter when you want to heat first one room and then another. To take a glowing fireplace from room to room seems ridiculous. But why should a whole house be heated when all that concerns you at the moment is the one room in which you happen to be sitting or working? Besides, coal is expensive these days, and never too plentiful.

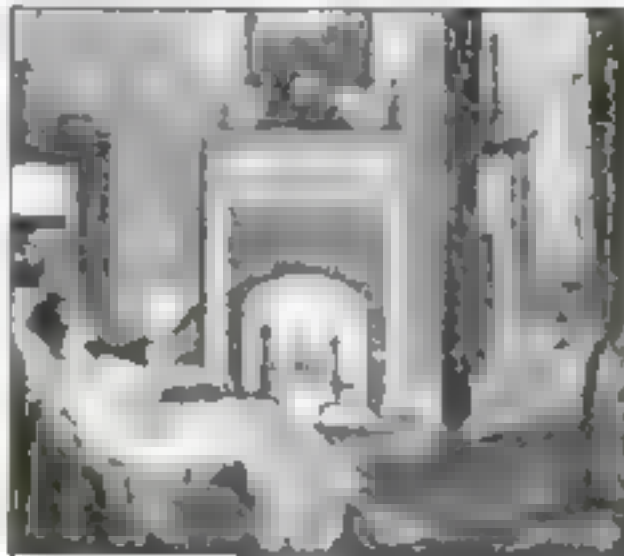
P. B. Martyn, of Airdrie, Scotland, solved the problem to suit himself by inventing a concrete cylindrical chimney into which is fitted a rotatable cylinder containing four fireplaces. The chimney occupies a place in the center of the house where all of the four rooms meet. Mr. Martyn places the stove within the chimney, and turns it so that the heat is radiated by the fireplace of the one room that needs warming.



The clever idea of a Scot for revolving the fireplace to the spot where it is most needed throughout the day

There are many days when a warm fire in the grate will take away the keen edge of the frosty air. Once the room is heated it will remain comfortable for a long time. On such occasions the whole house can be heated with the use of a single fireplace, thus saving three fires and the coal they would consume.

Brackets on the side of the fireplace conveniently hold the kettle of hot water and the teapot. Thus the domestic hot-water supply is switched around to the room where the afternoon tea is to be served. On a very cold day all of the fireplaces may be used simultaneously.



By switching the fire from room to room, one can snatch a few minutes' rest

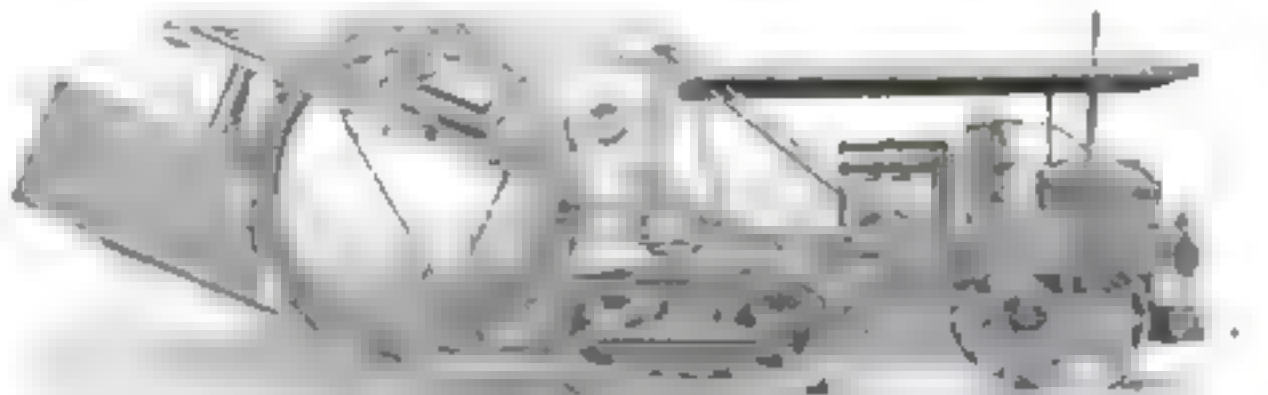
Digging Trenches Eight Feet a Minute

BUCKETS whirl around and dirt flies! With this digger, a trench about one foot wide and four and one half feet deep may be dug for a distance of eight feet every minute.

The buckets are on a circular frame that bring them in contact with the earth. They bite in and fill themselves. When they reach the top of

the frame, they are inverted and their contents fall on to a chute and slide into a wagon.

Two large sheet-iron plates follow the cutter wheel to prevent the banks from falling in. The cutter wheel is turned by the powerful gas engine placed on the front that gives the machine such an old-fashioned look.



The buckets on this circular frame bite into the earth, fill themselves, and when they reach the top, they are inverted and empty themselves

Learning to Crate and Box in School

IF you want to learn how to box and crate, what kind of wood is best, how to nail the crates or boxes to make them strong, how to strap, to bind, or wire the boxes, go to school and be taught. In this school (that of the Forest Products laboratory) is a large drum into which various kinds of boxes are put and thrown about with a violence that no truck-driver could match. Students watch the material go to pieces under the strain. Then they learn how to make the strongest kind of boxes and crates for shipping.

One subject is studied each day. Drop tests are made to show failures of different types of boxes; drum tests reveal the behavior of pieces on the sides and ends. Tests are made to show the relative holding power of

different kinds of nails, and the effect of using green lumber for boxes.

Then the various methods of strapping are illustrated, and the influence of the grade of lumber is shown. The student leaves the school knowing how to send freight safely and economically. But why is this so important a subject worthy of so much attention?

In 1919 one group of railroads expended just \$103,078,862 for lost and damaged freight. In one month twelve Western cities refused or repaired 43,738 packages. It is estimated that there is a daily loss to shippers and manufacturers of at least \$500,000



Siamese dances inspired Florence Meehan to make this little dancing figure

She Dances to Anything the Record Plays

THE latest phonograph novelty is a dancer who illustrates the record as it plays a dance.

About a year ago, Florence Burgess Meehan, of Chicago, saw the native dances as they were performed for her in the palace of the King of Cambodia. She had many pictures made of these dancers. In Java she found a Malay workman who was able to make reproductions of the dancers.

This model she brought back to America, and worked out a model that could be operated by hand. Then the idea of placing it on a talking-machine suggested itself, and now it is possible to witness a Siamese dance while listening to any dance record.

A jointed lever connects the small wire passing through the head with a wheel that touches the record. As the record turns, the lever moves. Another notched wheel connects with another lever connected with the body. This makes the figure dance.

Seventy Pounds of Meteor Every Minute

OUR planet is getting heavier and heavier! How does that happen? Because of the meteors that are constantly falling on it. You may not have seen any of them fall, but the earth is a large place. In a year eleven thousand four hundred and thirty-five tons of meteors fall! This gives an average of seventy pounds per minute.

Much of this tonnage comes in the form of fine meteoric dust that settles all over the earth. However, a large meteor—too big to burn on entering our atmosphere—falls occasionally. Several years ago one of them fell in Iowa and exploded on hitting the earth. Over five thousand pieces were picked up and some weighed over four hundred pounds.



These men are learning to box and crate. When their six-day course is finished, they will help save millions of dollars a year

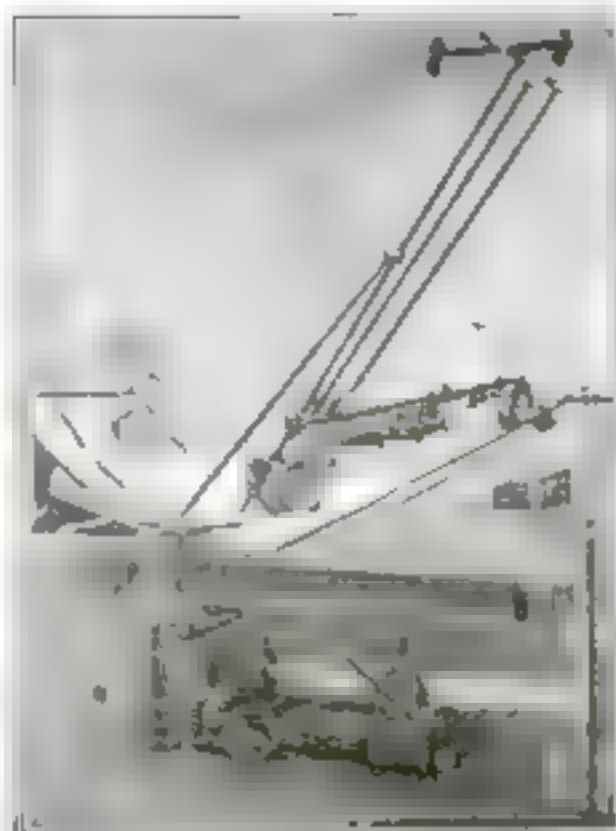
Broken Limbs Exercised in Bed

A VERY important detail, in treating fractures, especially those of the thigh, is that of preventing stiff joints. Exercises are usually prescribed, but these are carried on after the patient has left his bed, when the affected area is so stiff as to make exercise very painful.

Dr. O. Ansinn has recently devised a means of giving exercises in bed, before this stiffness becomes pronounced. In the case of a broken leg, the limb is placed, not in plaster-of-paris, but in a "tension" dressing, on a jointed plank support, which, when manipulated, imparts to the leg all the motions of walking.

The first time this apparatus is used, the nurse operates it; but the patient soon learns how to work it himself.

Dr. Ansinn has in addition invented an automatic apparatus actuated by a small electric motor or by a hydraulic ram. The patient himself controls the rate of speed as well as the starting and the stopping of the apparatus.



He himself manipulates the motor that works the apparatus for exercising his broken leg

The New Art of Self-Defense

Mental, physical, and moral perfection is the purpose of Professor Jigoro Kano, who has improved jiu-jitsu into jiudo

A man standing evenly balanced on both feet is like an upright pillar. A push and he is down

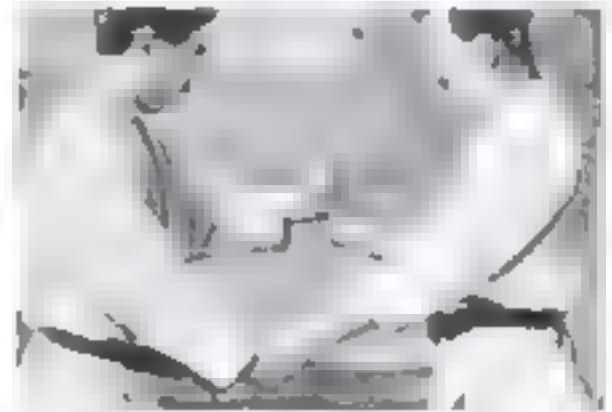
Learn how to trip your man—that, too, is part of Professor Kano's new art of jiudo



When an opponent seizes your wrists, how would you break his hold? See the next picture



When one or both hands are held down free them simply by a quick upward movement



The finger-tips are weak. This is a good reason for making your opponent use them



It's no use trying to upset a much heavier man. What's the solution? See the picture on the right. When the weaker man, keeping his own balance, pulls the stronger forward, using only part of his strength, he reduces the odds against him. Retaining half his own strength he has the advantage over his opponent



When an opponent strikes with his right arm extended and his right leg forward strangle him by pulling him forward and twisting him around

A quick pull and a quick turn around your hip and your opponent is unbalanced and thrown. And then—but see the picture at the right. Then he is easily tossed over on his head



The picture on the left shows a man trying to give a winging blow from the side, in that case you duck and grab his arm. The blow is warded off and the opponent is pulled out of balance. At

the same time by a quick upward movement of the leg and by falling down, the opponent is pitched over your head so that he comes down on his back—see the picture on the right





Making a Mailbox Out of a Barrel

USING his inventive genius, a farmer took a barrel, an old dish-pan, and a forked limb, and made himself a mailbox to protect packages from the weather.

The end of the barrel was first knocked out and a piece of the side wall of the dish-pan was cut to fit over the opening in the barrel to act as a protection against rain.

The end of the forked post was put in a hole and tamped in to make it solid, and the barrel nailed between the forks.

A piece of the barrel-end was nailed on top of the barrel on which is written the owner's name and rural route number.

The Machine Rotates and Plates

WE use many things in our daily lives that are electroplated with nickel, copper, silver, or gold. The plating-machine shown below will help to speed up production and make cheaper the plated things we buy.

The parts to be plated are hung from a metal wheel that revolves in the center of a series of anodes. The anodes are revolved in the opposite direction.

This arrangement allows a higher current to be used, and the heavier the current is, the more metal may be deposited within a certain time limit.



Catching Fish in New Guinea with a Spider's Web

SPIDERS spin their webs with the object of catching flies and other delectable insects. If a spider could speak, he would doubtless tell you that it is a long, tedious job, but worth while in the end. Imagine the feelings of the spider of New Guinea when he returns to his web and finds it gone—stolen by cannibals!

Mr. Spider bears a splashing in the brook near by. He goes down, and there he sees a woolly-headed man-eater catching fish with the web he had so carefully spun but a few hours before.

In New Guinea the spiders are as large as hazel-nuts, and they have great hairy dark-brown legs about two inches long. The webs they spin are often six feet in diameter and are very strong. The natives soon found this out, and they set up long bamboo sticks, looped at the end, in places where the webs were thickest. When the natives returned next day, their fishing-nets were ready for them—several unsuspecting spiders having spun their webs on the bamboo loops.



With This Plow a Horse Is Not Necessary

DID you ever hold down a horse-drawn plow? It is real work.

Here is a one-man plow invented by a German who had some plowing to do, but who did not have a horse. In fact, his little plot of ground was so small that the use of a horse was not worth while. That was just what made his invention practical. It can be used to cultivate small pieces of ground.

The one-man plow works with a lever action. When the lever is pushed forward, the plow-blades dig in and also move forward.

Radio Messages Between Cities

MAYOR THOMPSON of Chicago sends a radio message to Mayor Hylan of New York. Within twelve minutes' time the message is placed on Mayor Hylan's desk. It would take a much longer time to establish telephone connection.

Radio works fast. That is why the cities of New York, Cleveland, Detroit, and Chicago decided to carry on their official business by radio.

This rapid service is carried at a small expense, and no time is lost waiting for an "open" wire. It may not be long before all of our large cities are "connected" by radio.

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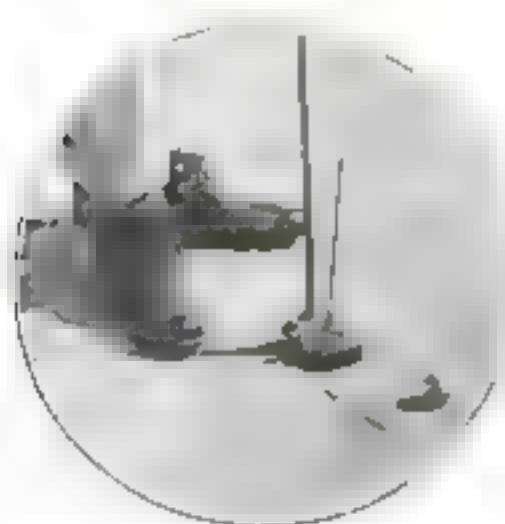


Cement Wallows for Pigs

A CONCRETE structure is the home of this family of hogs.

The cement piggery emphasizes the virtues of sunshine and cleanliness in the business of raising hogs. Iowa, Nebraska, Kansas, Missouri, Ohio, Indiana and other pork-producing centers have made notable progress in providing equipment that would exploit the theory that hogs are simply born filthy.

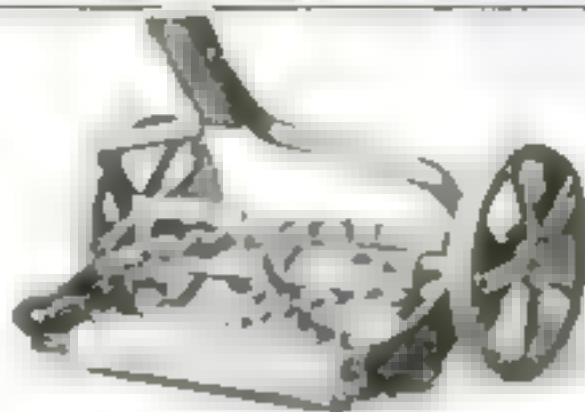
The truth is that hogs are given no opportunity to be clean. Comfortable barns for protection during the nights of chilling blasts and sanitary wallows for days of sunshine, constitute a well ordered piggery.



Golfers Use Sighting-Rod on a Putter

ONE of the chief requirements for successful "putting" in golf is to align or sight accurately the head of the putter, the ball, and the hole. Above you see a putter, to which is attached an adjustable sighting-rod, invented by Edward Hartford, of Deal, New Jersey.

By means of a graduated dial on the top of the club-head, the rod can be adjusted to any angle and locked in position by a thumb-screw. When not in use, the rod can be removed and carried in the handle of the putter, which is hollowed out. The sighting element is so designed that the proper club balance will be maintained. We doubt, however, whether the use of this putter would be permitted in most golf clubs.



Increase the Efficiency of the Lawn-Mower

EVERY man who cuts his own grass will be interested in a lawn-mower, for which the inventor claims that it will cut grass more easily. Its cutting edges are longer than those of the ordinary lawn-mower, although they do not require any more space. This feature is made possible by crimping the cutting edges.

"It will cut easier and handle taller grass," the inventor claims, but he fails to mention how he would sharpen the blades.

Marines on a Goat-Hunt

SO densely populated with goats had a part of Catalina Island, California, become, that they were a menace.

The farmers recently appealed to the commander of the Pacific fleet for help, and he detailed a squad of marines to attack the goat enemy.

In a three-day fight nearly six hundred goats were killed, and a number of mascots were captured for ships of the fleet.

It is said that many thousands of dollars were saved through the cooperation of the marines.



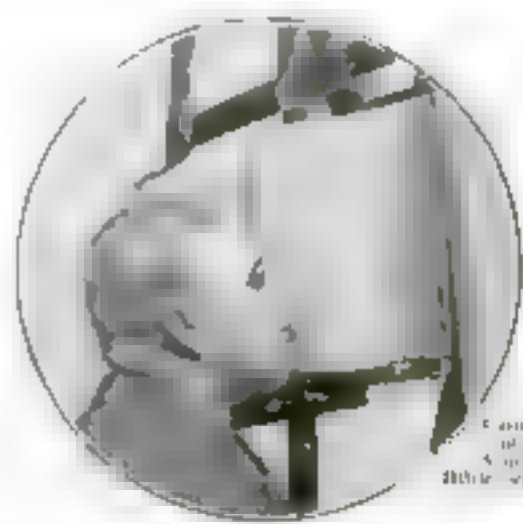
Gather Corn by Machine

THE mechanical picker is a labor-saving device, first introduced in the states of Illinois, Indiana, and Iowa.

This picker plucks the ears of corn from the upstanding stalks and deposits the grain in a wagon that keeps pace with the picker. One man or boy can operate it.

Three or four acres can be picked in a day. Two wagons accompany each picker, one unloading while the other is being loaded.

By covering seven acres a day, each acre yielding fifty bushels, the machine harvests 350 bushels.



Reading with the Tip of the Tongue

WILLIAM McPHERSON was superintendent of a large stone quarry in Colorado. A blast, for which he was not prepared, blinded him and blew off both his hands.

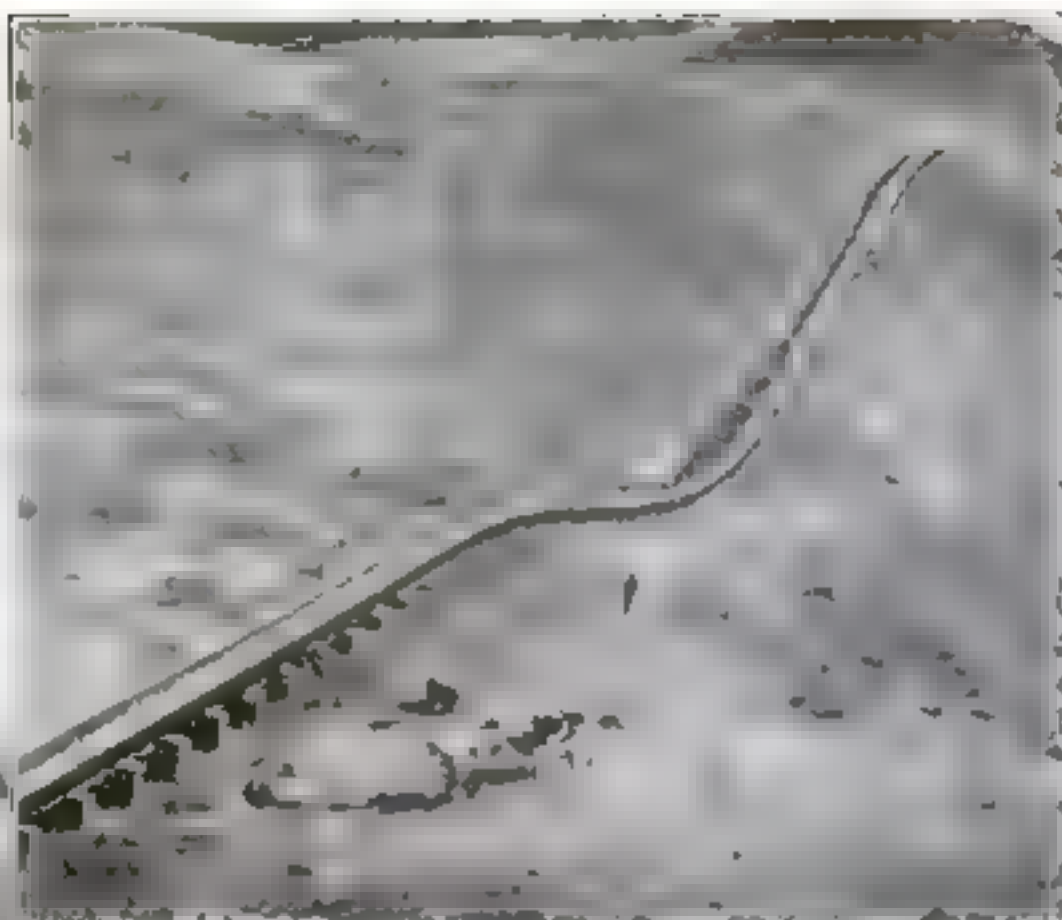
Confined in solitude, McPherson suffered only as one used to activity can suffer—until he heard of a blind woman who had discovered that when she kissed the Bible she could discern the raised letters with her lips. This gave him an idea. A friend taught him the alphabet in raised letters that he could read with his tongue.

A frame holding a Bible with embossed words has a shelf arranged with pulleys, so that a mere touch of the elbow is sufficient to raise or lower it.

This Purse Looks Like a Book

DURING the "crime wave," anything that looks like a pocket-book is attractive to the eyes of the purse-snatcher. Hence the ruse of a genuine book to camouflage the pocket-book.

The covers of a volume may hold memorandum leaves, or they may merely enclose an open space in which bills are carried. In his search for money the thief will probably respect such an innocent-looking object as a mere book.



Here Goes a "Monocar," a One-Seated Motor

THE vehicle illustrated below represents an attempt on the part of Brown and Roper, young English engineers, to solve the problem of a single-seated vehicle with the comfort and protection afforded by a car that has all the handiness and economy of upkeep of a motorcycle.

Starting with the idea of evolving something different from the ordinary motorcycle, the inventors have achieved a machine that has all the stability of a car at slow speed. Two small trailer wheels are provided for use in slow city traffic, but on the open road a touch of a lever lifts these trailer wheels and full speed is available.

The front wheel is steered by means of parallel reins attached to the steering head. A spring seat is placed low, aft of the gasoline-tank; and the feet of the driver rest on comfortable spring footboards.

Wooden Pipes Are Still Used

WITH the increased use of concrete, steel, and tile pipes, it is difficult to believe that large wooden pipes are still able to offer competition. One thing is in their favor, among others, and that is resistance to the influence of heat and cold. Blistering heat or biting cold does not affect them in the least. This big forty-two-inch wooden pipe looks like a huge snake stretching itself across the prairie. It acts as a siphon in the Sunnyside Project of the United States Reclamation Service.

Many of these big pipes are made of California redwood. This wood is fast disappearing, and before long the manufacturers of wooden pipe will have to be satisfied with cheaper wood.

The Wisdom of the Sparrow

VERY early in the spring, before the leaves are fully grown on the trees, the house sparrows build their nests. Thus the nests are plainly visible to passers-by. A few years ago Washington declared war on these birds, and as a result the nests were ruthlessly torn down. Nests were thrown over vine-covered walls and the luckless birds within were captured.

Did this persecution scare off the birds? Not at all. The following year they were back again—but not a nest was to be found! They built their homes outside the city.

Make a Lobster Stand on Its Head

UNDER the hard shell of the lobster's back are exceedingly sensitive nerve centers. When this part of the shell, the "carapace," is stroked or rapped with a stick a hypnotic state is induced.

The effect is probably similar to firing the retinal and optic nerve of the human eye by keeping a person that is to be hypnotized in the line of sight of a bright light.

A lobster that is always walking when it is thus hypnotized will stand on its head and will stay that way for five or six minutes.

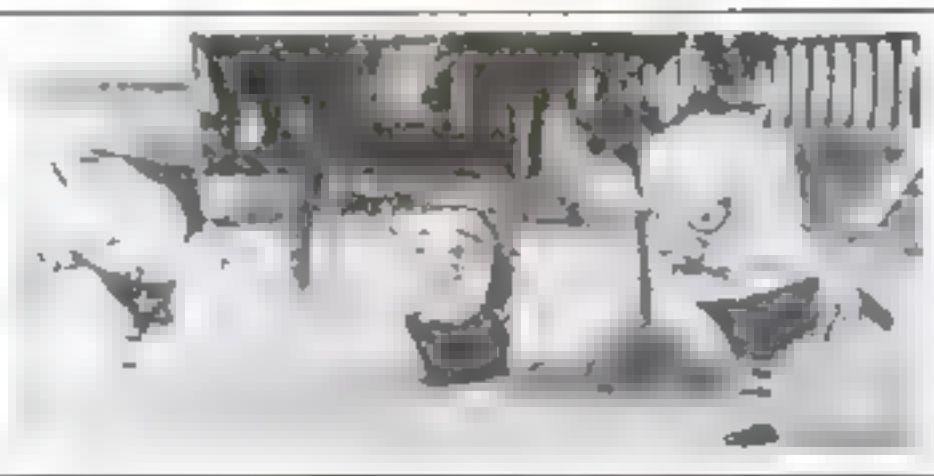


Japan's Greeting to the New Year

IN Japan this is the year 2581, and it belongs to the tenth year of the period entitled Taisho. On the day that marks the beginning of the new year, the Japanese children put on fantastic masks and have as much fun outdoors as do the children of any American city on Thanksgiving Day or Halloween.

The Japanese masks are grotesque and look clumsy; but they are made of paper and are therefore light. The curious quality of these masks is in the work of the color artist. But Japan is a country of artists, and whatever the Japanese do is managed from the viewpoint of how it will look.

Symbolism also plays an important part in the masks. They represent the figures of tradition, and many have a special meaning, other than just being grotesque.



At Four, He Owns His Own Sedan



IRWIN KRESSER, Jr., is four years old, and he owns a sedan car that fits him snugly. Except for the motive power, it is exactly like a large sedan. Irwin has to pedal in order to make his car go. There are headlights, lights on the dashboard, an electric heater, a speedometer, brakes, a horn, a winter top, and a summer top. There is room for another person besides the driver.

The body and the disk wheels are made of aluminum; tin drinking-cups painted black serve as headlights. The car is three feet high, six feet long, and will make a speed of three miles an hour if the driver pedals as fast as he can.

The joys experienced by the driver of a flivver when he passes a high-powered car are nothing to Irwin's as he tries to keep up with his father's car.



Baby-Carriages for Fishers

THERE is a man in Redondo, California, who wheels a perambulator to the dock every time he goes fishing. Minding the baby while he waits for a bite? No; his perambulator contains fishing tackle and assorted bait, arranged neatly in drawers and on shelves. There is no child present.

At the front of the perambulator there is a seat on which the fisherman sits while he angles for small fish. At the back of the perambulator there is a bracket that holds a large fishing-pole set for large fish.

A small cement garage houses the perambulator when it is not being used. There is a drop-door to the garage, which when let down serves as a runway.



Five Years of Fires

NEARLY a billion and a half dollars' worth of property has been destroyed by fire in the United States during the last five years. New York state is the chief sufferer, her losses being a tenth of the total. Pennsylvania comes next with a loss half as big as New York's. Illinois is third, New Jersey fourth, and Massachusetts fifth.

What are the chief causes of this tremendous waste? Statistics show that defective electric wiring heads the list next comes matches—smoking (do the "antis" know that?); and the third cause is defective flues and chimneys. Stoves, furnaces, boilers and pipes, lightning, spontaneous combustion, sparks on roofs, and petroleum all help the bad work along.

Off with the Barnacles!

EVERY year millions of dollars are spent scraping the barnacles off ocean-going vessels.

Inventors have long striven with the problem of removing barnacles by machine without taking the ship out of water.

At last a machine that appears to have some promise has been developed. A long revolving brush, with wire bristles, is lowered into the water and brought in touch with the ship's sides. This is driven by powerful electric motors that are thoroughly protected from the water. When the brush revolves, barnacles fly

The Largest Rain-Gage

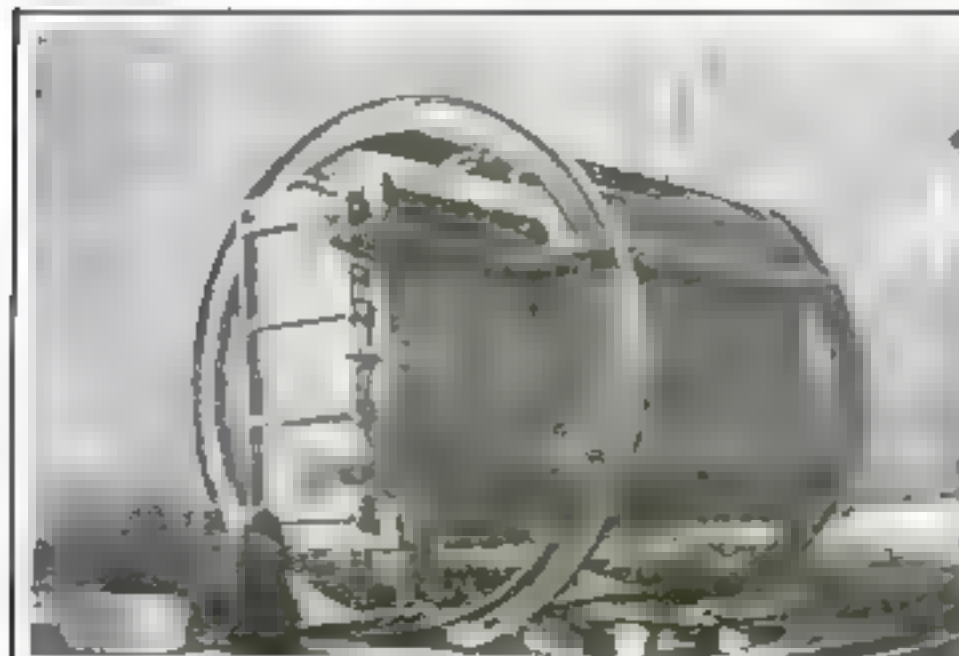
MOUNT WAIALEALE, of Kauai Hawaiian Islands, is the rainiest spot on earth. The United States Geological Survey measured the rainfall with a gage. The summit of the mountain is probably the most inaccessible place at which a rain-gage has ever been installed and maintained. Only the most expert mountaineers can climb to it, and the visit entails a three-day trip.

In order to meet this difficulty, the Survey decided to install a gage so large that it would hold a year's rainfall. The gage placed on Waialeale in 1910 had a capacity of 600 inches, but proved too small. The present gage, installed in 1920, holds 900 inches.

Tipping the Whole Freight-Car

WHY place three men in a car to shovel out coal, when the entire car can be clamped in a frame, given a twist and turned over? A day's work is finished in fifteen minutes.

So rapidly does this tipper work that ten cars of coal can be handled in one hour. A six-horsepower motor turns the tipper, and the coal falls into the big bins below. When the car is righted, the rails are in perfect alignment and the car is pulled or pushed away to the "empty" track. The car is clamped to the tipper during the turning.





Not Grass but Green Concrete

RATHER than struggle with lawnmowers, weeds, and worms, Mrs. Woodward, of Los Angeles, had a concrete lawn built around her house. It is painted grass green, and from a distance it can not be distinguished from real grass. What is more, the concrete is perfectly smooth and makes a good outdoor dance floor.

The concrete lawn needs very little attention—just a coat of paint once a year and an occasional washing. There are circular openings in it, and real flowers are planted in them.

One Reason for Oil Shortage?

OIL-BURNING vessels to the number of 618 were in use in the United States in the year 1920.

Has the increasing use of oil on vessels had anything to do with the recent acute shortage at Atlantic coast ports? It has been suggested that in order to conserve oil for use in the merchant marine, where it shows great savings in greater dead-weight capacity, it would be a good plan to discourage stationary plants from using it.

Although He's Blind He Runs His Own Drug-Store

THIS blinded soldier manages to run his own drug-store and make a comfortable living without having had to learn a new trade.

How does he know the difference between a bottle of sulphuric acid and a bottle of toilet-water? He does not need to smell them; he uses the Braille system of raised letters. Every bottle, and the various compartments containing the different articles dispensed by a druggist, are labeled with Braille letters.



Rackets of Laminated Wood

SUITABLE material from which to manufacture tennis-racket frames is becoming scarce and there is a consequent increase in the percentage of bad rackets. The Forest Products Laboratory at Madison, Wisconsin, has been working on a method of building rackets entirely of veneer.

The picture shows several steps in the manufacture of these frames. The veneer is glued in wide strips, including cross-banding of a darker-colored wood that appears as dark stripes on the frame when the large piece is cut into sections. From this point the process of manufacture is the same as for solid construction.

Your Skin Tells Your Age

ONE way to tell whether you are getting old is to hold the back of your hand with its fingers outstretched and with the other hand pull up the skin. If it quickly snaps back into place, you are young. If it comes down slowly and stays puckered in a ridge, you are old, no matter how few the trips you have made around the sun.

"One is as old as his skin," because the skin is kept in health by the gland in the neck known as the "thyroid." To this gland the blood goes to be relieved of certain poisons.

The St. Lawrence Boat Store

BANKRUPT merchandise legally brought from parts of the U. S. A. The announcement is painted along the side of a boat that travels the St. Lawrence river.

Pirates on board? No; honest men who buy merchandise at bankrupt and auction sales and sell it cheap. The boat is their store.

This boat is towed from place to place. In summer it is usually around the Thousand Islands; in winter near Ogdensburg, New York. The inside is fitted up like a store.

Controlling Humidity in Shops

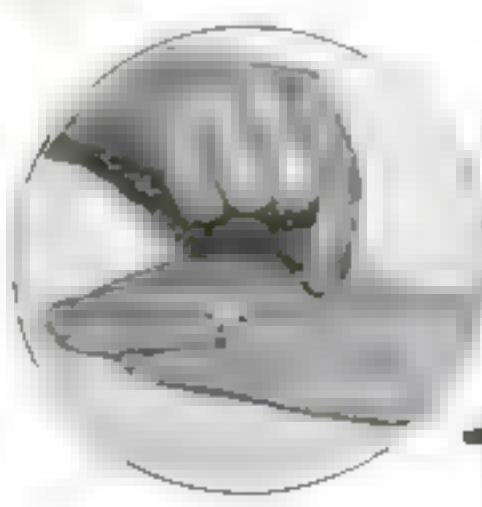
AN apparatus for the "conditioning" of air in shops has been evolved by the Forest Products Laboratory at Madison, Wisconsin. It consists of a small cabinet in which water-sprays suck in the air, cool it, and moisten it.

All this is preparatory to bringing the air to the temperature desired. This is done as the air leaves the chamber, by a coil, the steam supply of which is controlled by a thermostat located at the outlet.

Can You Concentrate on Five Things at One Time?

HERE is an apparatus that decides whether you can concentrate your mind on several things at once. It comprises five U-tubes of mercury, which is made to rise and fall at a variable rhythm. The subject must control the mercury in the tubes to keep it level. To do this, one must concentrate on five different impressions at once.

The subject keeps his hands on five knobs, each corresponding to a tube, and when the mercury rises beyond the mark, he presses down that tube's knob, withdrawing his hand when the mercury moves



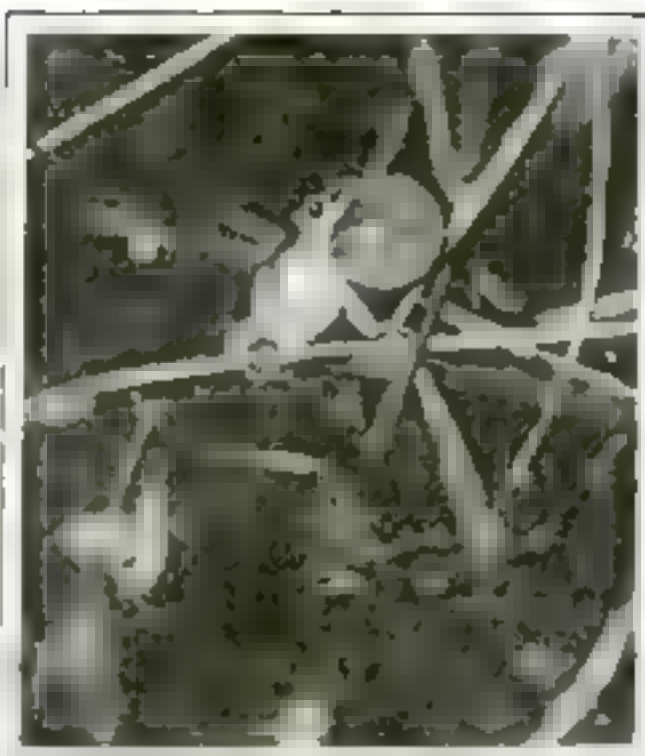
Carry Your Table to the Picnic

ARE you a motorist, an engineer, a camper, a nurse? Then you will undoubtedly be interested in the folding table invented by P. J. Risdon. It is very light in weight and when not in use will fold up into an oblong package that measures fourteen by thirty by one and a half inches.

When it is opened, this table is five feet long and will accommodate several people.

The legs of the table have spikes at their ends that sink into the ground and give the table firm support. Thus it is very useful for serving meals outdoors.

In a hospital, the table will span a patient's bed so that it can be used for eating, writing, and supporting books, and is especially useful during the trying period of convalescence.



Is This Frog Blowing Bubbles?

THE little green "spring peeper" that lives in the marshes of Long Island sends out his voice so loud at night that it can be heard half a mile.

The photograph above, by Dr. Frank Overton, of the American Museum of Natural History, was obtained by flashlight. The frog inflates a thin membrane in his throat, and this serves to intensify the sound. The pouch is inflated through small openings in the frog's mouth.

There are other frogs that use this "resonator," and the sounds vary from a coarse *krr-r-r-r*, to a note that equals the bluebird's song.

Keeping the Grinding-Wheels Continuously Wet

SHOWN below is a grinding machine equipped with a small pump that pours a stream of kerosene on the cutting surfaces of the three wheels. This tends to keep the tools cool and save them from wear.

High-speed tool steel is very easily "burnt" if it is allowed to remain in contact with the grinding-wheel too long.

When kerosene or water is used to keep the tool cool, grinding is facilitated and all danger of damaging the tool is avoided. The kerosene runs off the wheels into a big pan, where it is again picked up by the pump and forced back into the piping system.

Three wheels are used on the machine, one for coarse work, one for medium, and one for fine work.



Into the Hippo's Mouth

ONCE "Mogul," a hippopotamus long a resident in New York's Central Park Zoo, was wild and fierce. He thought nothing of overturning hunters' boats as an interlude to his morning's bath, and if the hunters waited long enough, he would finish their adventures then and there.

But Mogul has reformed since then. He is now a proud exhibit of the keepers. The picture tells its own story of their confidence in his gentleness. Nevertheless, when this particular keeper was preparing for his sensational act before the camera, he instructed our photographer to "shoot quick."

Famous Brains Now Shelved

IN the Museum of the School of Medicine, in Paris, can be seen a number of models of distinguished brains.

Note the mold on the second shelf from the top, the second from the left. It is the brain of the famous scientist Berthelot. Within its convolutions originated the method of proving that organic compounds, such as fats, sugars, and other substances, could be synthetically produced without the intervention of some mysterious vital activity.

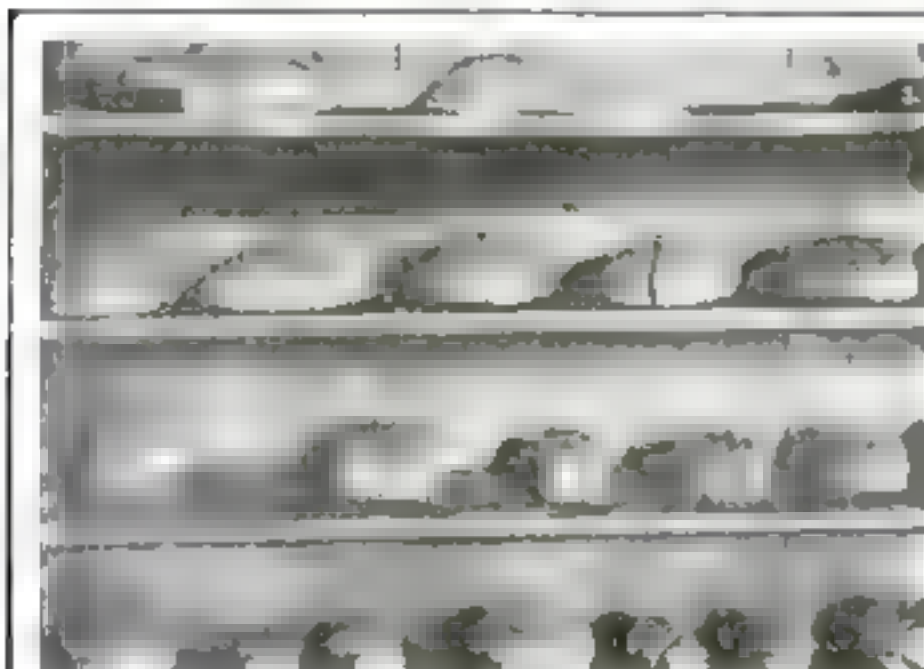
Next is the brain of Gambetta, the famous French statesman, while on the same shelf the fourth from the left, is the mold of the brain of Troppman, a noted French criminal.

Removing Moss from Canals

WHEN moss grows in canals, it soon causes trouble. Yet how to remove it?

George E. Stratton, of the United States Reclamation Service, offers several suggestions. If there is plenty of time, the canal can be dried out; the sun will kill the mossy growth. When the moss is stiff, submarine saws will cut it.

Dragging the bottom with a harrow is sometimes resorted to, but a chain is more effective. Thirty-three miles of canal were dragged with a chain at a cost of also dollars a mile.



Hats of Wood and Paper

They appear just as attractive as the more expensive spring hats

Why pay twenty five dollars for a hat when you can get one for twenty-five cents? A cardboard frame covered with crepe-paper and trimmed with paper fruit will develop into a pretty hat that costs but a quarter

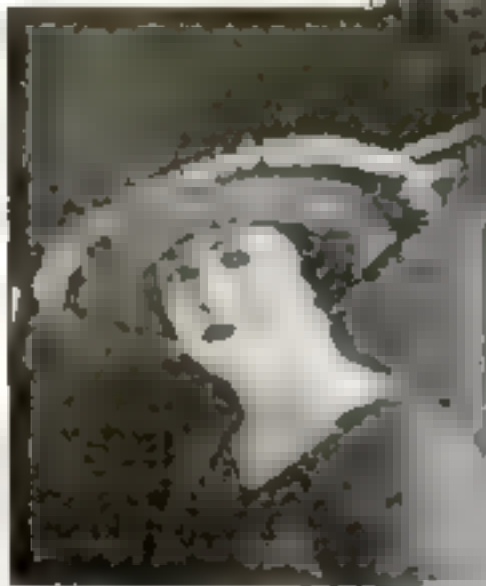
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"It is fortunate for this young woman that Hansel and Gretel never came ago for her hat is made of candy. We hope it doesn't grow sticky when the sun shines on it."



"Don't sell your old newspapers to the junk man," says Miss Arcade Fanning, of Dover, Delaware. "They make excellent dresses and hats." She is shown here wearing her newspaper hat.



© Kable & Feltner

Yellow pine shavings were shaped and given a coat of molasses' varnish. They make a very becoming hat and look, at first glance, like gold-colored velvet.



As long as the aristocratic vine blooms, this girl will have a new hat every day. She plucks one of the large leaves, turns it upside down, and drapes it on her head.



Crepe paper hats come in all styles. They may be stiff and tailored, or profusely ruffled—and they cost only a quarter of so!

A Dog's Life

Dogdom has its laborers and its idle rich just as humanity has

He does so much motoring, you know. Fearful strain on the eyes, hence the spectacles

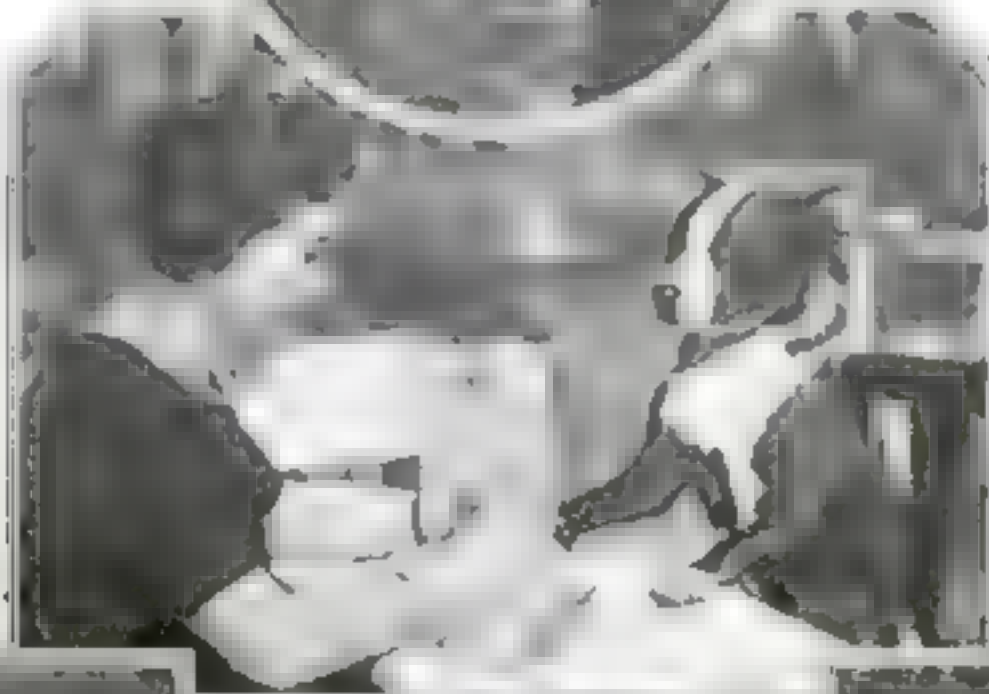


© Kadel & Herbert

Here you see a blind soldier. His dog, formerly an idler, has forsaken a life of ease to lead him safely through city streets. The dog wears a harness to which a handle is attached the master grasps it firmly as the dog forges ahead

© Kadel & Herbert

Why does this dog carry a parasol? Not to protect his complexion from the sun, as one might suppose, he does it for business reasons. Advertisements are painted on the parasol and on the dog's jacket. he is paid a regular salary for parading through the streets each day



A sudden rise to fortune often affects one queerly. This dog, rescued from the streets by a theatrical man is now a star and he finds he must be manicured at least once a week



© Kadel & Herbert

What is one horsepower equal to? In this case it equals one dog plus one man-power. When the horse that formerly hauled the cart passed into the beyond, his master could not afford another. He harnessed his dog to one shaft and carried the other one himself



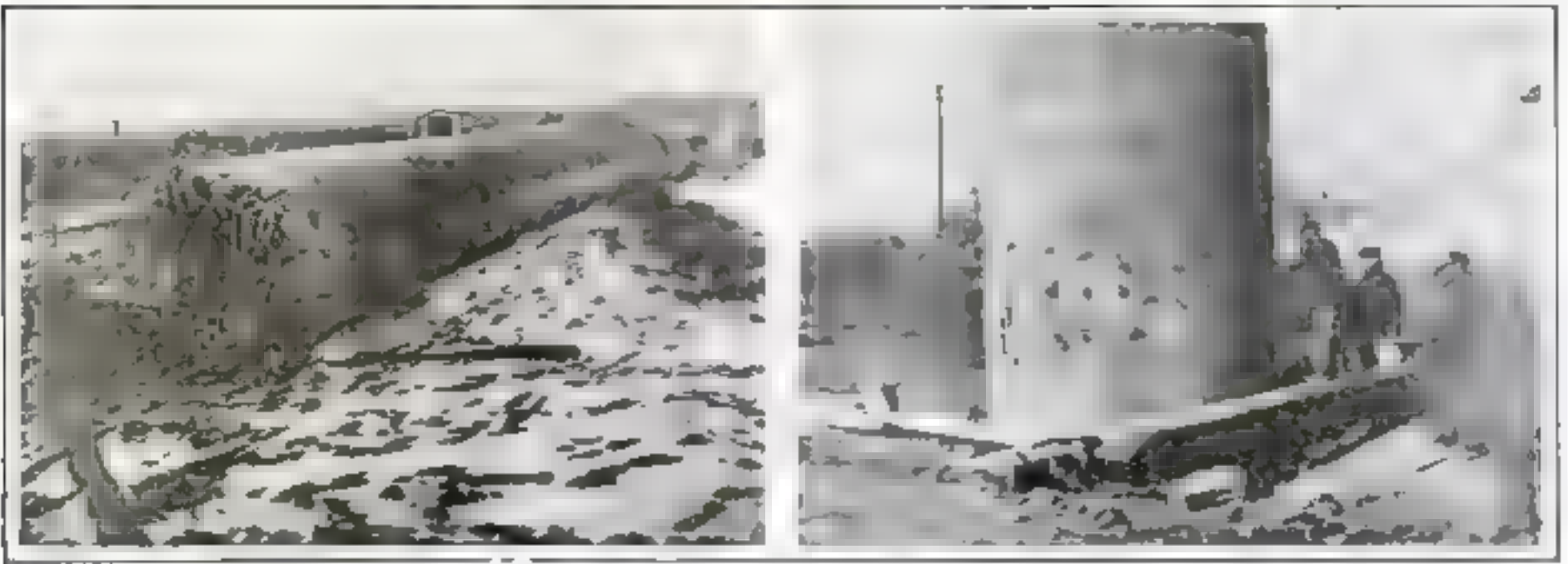
© Kadel & Herbert

This dog knows ship's time as "bells." He rings the hours and half-hours by pulling the bell-rope with his teeth



© Kadel & Herbert

Here's a dog that hears more music in a day than the operator in a moving-picture theater. He draws a street organ around town and stops in every block, the minute he stops the music starts. Surely there are some days when he feels like breaking loose



Two hundred tons of concrete and steel brought down with a crash. It cost two hundred and fifty-four dollars to fell this stack.

It was a tough job to bring this big concrete stack down. Sixty-five holes had to be drilled in its base on the side toward which it was to fall.

How They Felled Spokane's 210-Foot Stack

IT would be exciting to see a 210-foot concrete stack, weighing two hundred tons, fall to the ground with a crash. That is what happened in the city of Spokane. The city engineers were called upon to bring the stack to the ground, and a short time after the order was received two hundred tons of concrete and steel lay sprawled out, a bent and broken mass.

A new building had been erected a short distance away. If the stack had been allowed to fall on this, great damage would have been wrought. On the other hand, if the stack fell to the south, several thousand dollars' damage would have been done to the

railroad property. It simply had to fall "just right."

Before work was started to weaken the base of the stack, an attempt was made to attach a heavy rope to the top. A gun to shoot the rope over, used by the fire department, was pressed into service, but the height was too great. A light scaffold one hundred feet high was built inside the stack. A hole was cut through the concrete, and a heavy anchor carrying a three-quarter-inch cable was hoisted. This was connected with a windlass on the ground, which could exert a pull of twenty tons.

The workmen then hacked at the

base of the stack with their chisels and hammers. They drilled sixty-five holes around the base on the side toward which it was to fall. Several small charges of dynamite were then put in place and exploded. The stack listed several inches, but refused to fall. A hurry-up call was sent in for oxyacetylene torches. The exposed steel ribs were cut. Still the stack insisted on standing.

Another charge of dynamite was set off. This was the last straw. The great mass of concrete and steel started to sway. Slowly, then with increased speed, the stack moved earthward. There was a crash and all was quiet.

Electromagnetic Clutch Regulates Its Own Power

TWO Englishmen, Messrs. Davies and Soames of London, are the inventors of an ingenious electromagnetic clutch that can be used automatically to regulate the electrical output of a generator or the mechanical driving power of a motor. There is no mechanical connection between the driving and driven parts of the clutch—only magnetic attraction, the extent of the magnetic force exerted being in proportion to the electric current passed through the electromagnetic coils.

The device is particularly valuable in instances where the generator of a motor-generator set is suddenly overloaded or short-circuited. Under such an extreme condition, the clutch has its magnetic pull automatically cut down, so that there is slipping between the driving and driven parts, preventing damage to the generator windings. It is therefore very desirable for machinery that is subject to sudden

overloads or shocks that would burn out or otherwise damage electrical units not equipped with the clutch. The clutch could also be used to protect machinery likely to be jammed, such as anchor-winches, capstans, and winding drums.

Briefly, the clutch has two main coils, one in the driving member and the other in the driven member of the

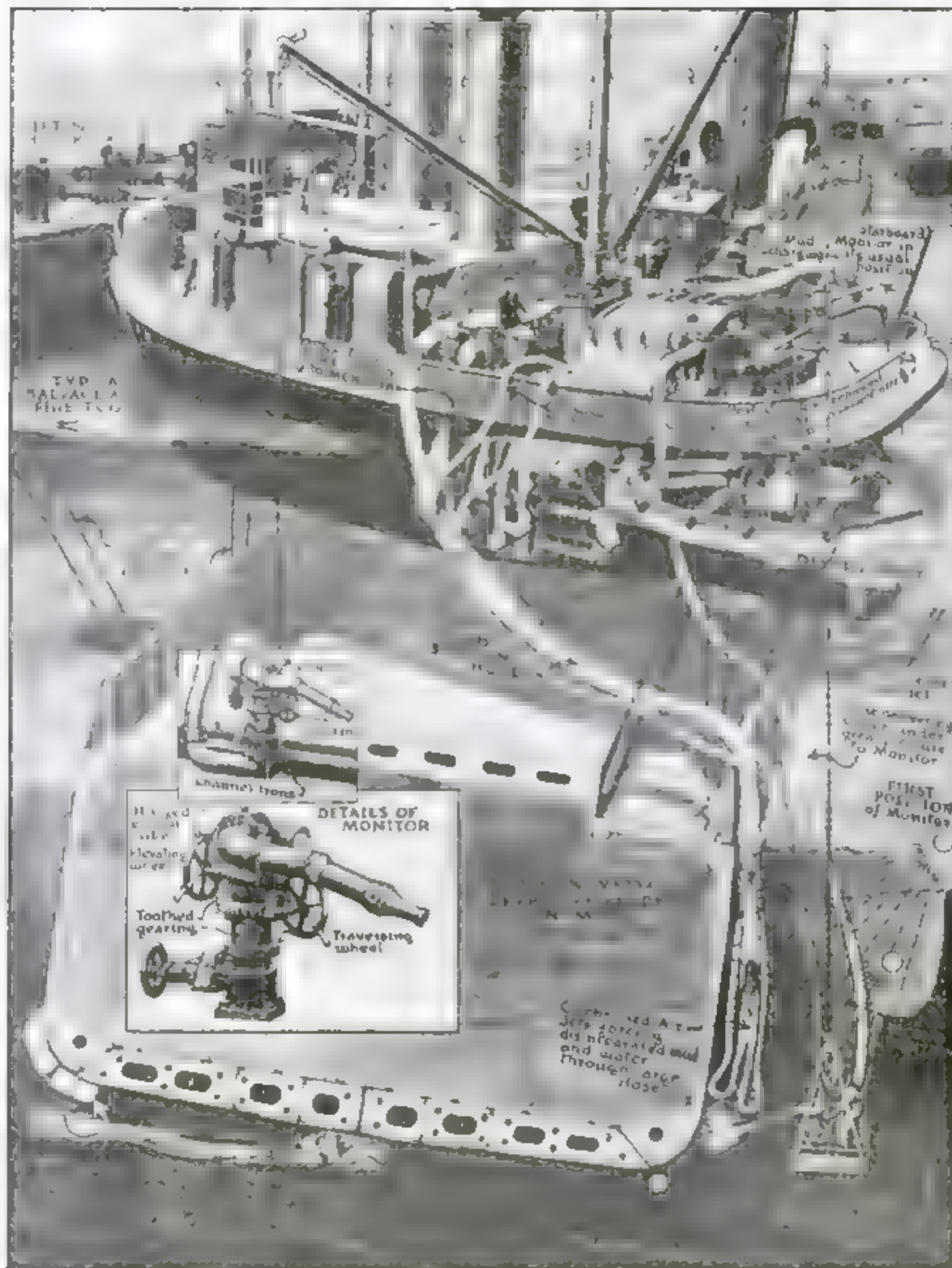
mechanism. Initially only the driving member's coil is energized, thus attracting the driven part magnetically and pulling it around with it. Suppose the clutch is used for a connecting-link between the shaft of an electric motor and that of a generator. As soon as current is taken from the generator—that is, as soon as some electrical load is put on it—the coil in the driven part of the clutch is energized also. This has the effect of opposing the magnetic pull of the coil in the driving part of the clutch, and hence the resulting magnetic force seeking to make both parts of the shaft rotate together is lessened.

When the generator's electrical load exceeds a certain amount, the opposing magnetic actions of the two coils neutralize each other and there is no longer a driving connection. This, therefore, slows down the generator until its load is normal. Then the coil in the driving part again dominates.



The clutch has two main coils, one in the driving member and the other in the driven member of the mechanism, the driving member's coil attracts the other.

How a Fire-Engine Raised the Ships at Zeebrugge



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News by 5 W 2 a.m. only

WATER pumped under a boat embedded in the muddy bottom will help to raise her. From a fire and salvage tug above the wreck a hose runs down. Through a larger discharge hose refuse mud and water is sucked up.

A diver guides the water hose down to the bottom of the hull embedded in the mud. The strong current of water from the nozzle bores a hole in the muddy bottom. Working from the opposite side of the wreck, another diver carries a guide rope to which are attached the hawsers.

which must be passed around the hull to lift the boat. The monitor, or "water gun" which forms part of the usual equipment of the fire tug, is dismounted, placed upon a platform, and lowered. The method was first used with complete success in raising the blockships at Zeebrugge. These vessels were heavily weighted with concrete and deeply embedded in the mud. Captain Sir P. W. Young, of the British Admiralty, successfully accomplished the work.

Curing the "Bad Eye" Habit

Professor Scott's machine to speed up slow readers

By Raymonde G. Doyle

EARLY in the year announcement was made that the educational department of Springfield, Massachusetts, had decided to increase the reading capacity of the school children; and that Professor Colin A. Scott, head of the Department of Education at Mount Holyoke College, would direct the work.

Strange as it may sound, Professor Scott is accomplishing his purpose with the aid of a machine—a device of cogged wheels and sliding shutters and speed controls that might be called an "eye-jolter."

Early tests showed that the reading capacity of both children and adults varies greatly. It was proved that if 22 per cent of all the people in the United States cannot read at all, there are probably not more than 25 per cent who find any comfort in reading even the newspaper. Graduates of high schools were able to read material as difficult as the ordinary news items at the average rate of 310 words a minute. Some read as slowly as 150 words a minute, while others progressed as rapidly as 450 words a minute. Those who read more rapidly, it was found, were usually able to give as good an account of what they read, and of course a longer account, than those who read more slowly.

Ultimately Professor Scott found that the rate of comprehension was a large factor in determining speed reading.

Another point made clear by the tests was that certain mechanical habits are formed by children, and that some of them interfere with both speed and comprehension. Among them was the habit of fully pronouncing words mentally while reading silently. The rapid reader never does this, although he can not get along without some pronunciation. He telescopes or slurs his words, a great advantage in silent reading, but a drawback in that it tends to make the individual a slipshod speaker.

The next step was the determination that the rapid reader had a great positive advantage, chiefly because impressions passed before his mind quickly and crowded together into one focus, thus unifying within the span of a few seconds the different elements that went to make up a thought.

Then Professor Scott gave his attention to the movements of the eyes as they pass over the material read.

"The reader," he says, "usually



Professor Scott exposes a section of printed line, covers it up, and exposes the next section: if the pupil reads slowly, the machine is geared up to a higher rate of speed—literally "jolting" his eyes along



The top photograph records the movements of an eye reading a magazine line. The dots and hesitant lines at the left indicate difficulty in starting. The well defined shifts show that the line was read in four sections. The lower photograph shows the reading of a newspaper line (half the length of the magazine line). After one false move, the eye traveled over the line in six jumps, taking about twelve letters at a jump

assumes that his eyes glide evenly over the line unless he should be stopped by something not properly seen or understood. Accurate observation, however, shows that this is not the case.

"A good reader takes in twelve or thirteen letters in one glance. In order to do this, the eyes rest for a fraction of a second, usually about one third of a second. They then move rapidly to the next section, and so on.

"These sections doubtless overlap somewhat on the edges and are of slightly irregular lengths. The eyes move a certain distance and then stop, whether the distance moved is exactly the same as on the previous section or not. The line of travel is along the

upper portion of the line, but the center of the resting-point may be, not a letter or a word, but a blank space. This makes no difference to the vision, since it is a certain section that is seen, not successively, but at once. In an ordinary newspaper line, a rapid reader will make only three stops, and will thus be reading about 350 words a minute. A slow reader, on the other hand, makes as many as seven or more stops and reads perhaps only 160 words a minute."

As a result of his highly important observations, Professor Scott has drawn the conclusion that about half of the slow readers continue to be slow even when the material read could be comprehended by them much more rapidly. Not lack of comprehension, but the persistence of a "bad-eye habit," prevents their reading rapidly.

At this stage of his work Professor Scott began to see a glimmer of hope. He invented a machine to correct the "bad-eye habit" of slow readers.

Professor Scott's machine exposes a section of printed line as it would be seen by a good reader, covers it up, and exposes the next section at whatever rate may be found comfortable for the pupil. If, however, the pupil reads slowly, the machine can be geared up gradually, almost imperceptibly, to a higher rate.

The machine has proved that the shutting off of an exposed section of a line, the exposure of the next section, and so on, does not interfere with the creation in the reader's mind of an impression of what he has seen.

The impressions "overlap," and the full import of the text is grasped easily.

Now, if the reader had been left to struggle along in his own way under the handicaps of a mechanical defect in eye movement, what would have happened? Undoubtedly he would have hesitated and lingered on this one line, and divided it into four or five or possibly six sections. But the abrupt shutting off of the first section of the line compelled him to shift his eyes to the next. Literally, his eyes were "jolted" along when his own inclination was to go slowly.

Gradually the eyes become accustomed to being forced to jump ahead, and they jump of themselves. The reader becomes oblivious to the motion of the shutter, and at the end of six weeks is able to read without it at about the same rate as with it.

Will the Tides Light London?

By P. J. Risdon

ON the Severn river, England, at high spring tides the difference between high and low water amounts to nearly fifty feet. At ordinary high water the river can accommodate the largest ocean-going vessels; at low tide such vessels cannot navigate.

The suggestion has been made that the river should be dammed to retain the water at a minimum depth sufficient to form a locked basin of twenty-seven square miles, affording anchorage for fleets of steamers. This would result in a new shipping center; a new port would develop.

In conjunction with this scheme, there is a proposal to utilize a portion of the immense potential power of the tides.

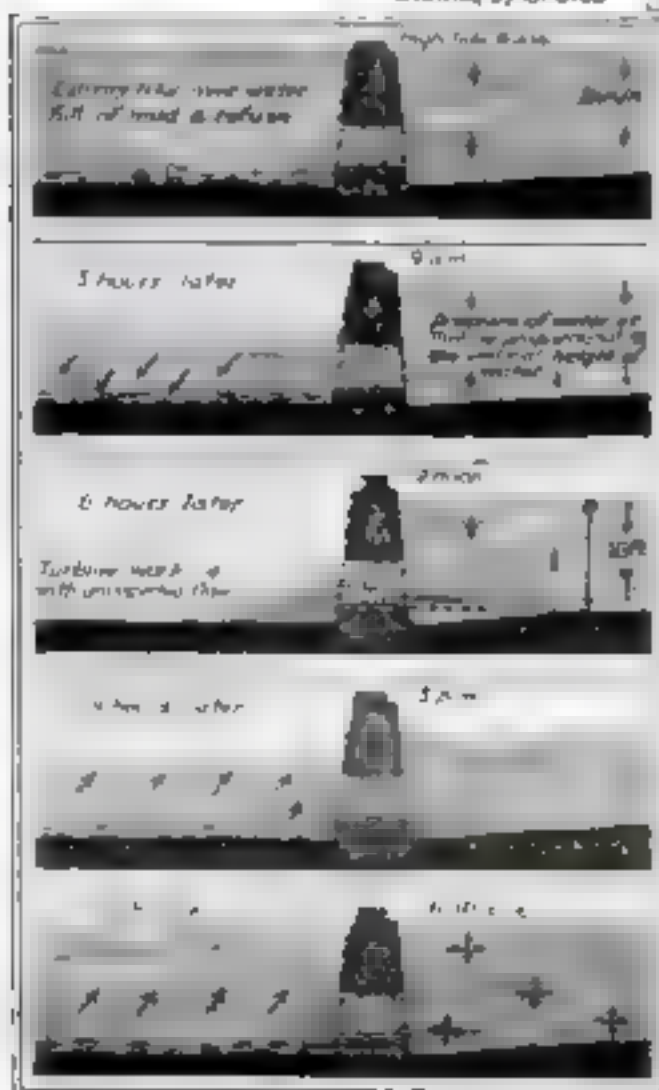
The water available is declared sufficient to generate 500,000 horsepower ten hours out of twenty-four. The estimated cost is \$150,000,000. The tidal power derived would return at least 5 per cent. on the outlay.

A viaduct is to cross the main channel, and in this viaduct a lock is provided, capable of passing the largest vessels. As the locking through of ships would delay traffic, a loop viaduct is provided, so that traffic could be diverted. At each end of the lock a lifting bridge would be provided. The ships would be manipulated by electricity. On each side of the channel below the lock a dam would be constructed to the height of high spring tides.

In the portions of the dams lead-



Drawing by G. Gros



At the left is illustrated the action of Severn's tides on a turbine. There is enough water to generate 500,000 hp. a day

A. Concrete dams
B. Automatic water-gates operated by the tide
C. Highway and railroad

D. Ship lock
E. Shipping wharves
F. Lake ten miles away
G. Future development area

ing to the lock would be placed water turbines. The turbines would be operated by varying water pressures, as work would begin with a head of only a few feet, increasing to thirty feet at low water. The turbines would operate electric generators.

In the section marked B in the diagram above, enormous automatic water-tight gates would be provided, capable of opening upstream only. Suppose a tide to have reached the level of the water above the dam; the pressure thereafter would be greater outside the dam, and would force the gates open, allowing the tidal water to flow upstream and raise the water level in the basin to high-tide level. With ebb tide the pressure would be reversed, and the gates would automatically close and retain the water.

In the neighborhood of Tintern

(ten miles away) is a lake to which it is proposed to bore a tunnel, forty feet in diameter, through solid rock. The object is to enable the generating plant, in a power house on the banks of the river Wye (when the power demand is less than the power generated), to pump water to the lake, whence it would flow to turbines in the power house and be used for generating electric current during high tide, when the other plant would be idle.

As the electricity generated would be far in excess of local demands for many years, it is to be converted to high-voltage current and transmitted to industrial areas.

It is within the bounds of possibility that a man in London may glance at the electric lamps in his house, and reflect that they are consuming current indirectly generated by the moon in mid-ocean.

Mother to the Seaplanes

By Graser Schornstheimer

THE aircraft carrier is one of the most important developments of naval war. With aircraft for spotting purposes a battleship's gunnery was improved 30 to 40 per cent.

An aircraft carrier must be repair base, fuel base, and launching and landing platform for airplanes. She must have speed, for the fleet is only as fast as its slowest ship.

The former collier *Jupiter*, equipped with the electric drive, has been remodeled to carry planes, and renamed *Langley*.

A large deck is required as a launching and landing platform. So the *Langley* ejects her smoke through the sides by tubes that carry it aft before discharging it. All modern ships must have masts for radio equipment, and masts that telescope into the ship have been fitted to the *Langley*. The elevators that take the airplanes to and from the platform rise so that the floor of the elevators is flush with the platform.

Below the platform is the main deck on which are hoists to lift seaplanes and place them in repair-shop or hangar. This is also the gun-deck upon which four five-inch guns are mounted. The quarters for the ship's complement are located here.

Below this deck lies another on which are the hangars, where all the seaplanes not under repair are carried, also the repair-shop.

A crew of twelve officers and a hundred and seventy-

nine enlisted men will be carried in addition to the aviation complement.

The *Langley* will probably carry thirty airplanes. Both land and sea types will be used, divided into these classes: fighting planes, scouting planes, scouting and spotting planes, torpedo planes, and possibly some bombing planes.

The *Langley* is probably too slow for the duties she is expected to perform. All battleships have a speed of twenty-one knots; the *Langley* has but fifteen.

The position of the aircraft carrier with the fleet is in the smoke screen. Then it can help ward off destroyer and submarine attacks and make the scouting planes more efficient. For this service a ship needs every knot of speed that can be given her.



To be an aircraft carrier a ship must have a large, clear deck, and she must have speed enough to keep up with the fleet



He is receiving radio messages with a small apparatus that looks like a book

It Isn't a Book, But a Radio Outfit

HERE is a radio outfit arranged in a flat box. The man puts up a small aerial, on a cane, takes out his "book," adjusts his receivers over his head, and combs radio messages from the sky. He "tunes" his outfit to different wave-lengths by adjusting the covers of the book.

When the book is wide open, the radio equipment is ready to receive from stations with long wave-lengths. When the book is closed, the outfit is tuned to receive messages from small amateur stations.

Signals have been received over a distance of 300 miles.

to Carry Passengers and Mail between Lille and Turcoing



This novel system of locomotion has been approved by the Commission Interministérielle, which was nominated by the French government to make an investigation. Construction has already begun on a line running between Lille, Roubaix and Tourcoing.

The line is designed for the transportation of passengers and mails, being constructed to provide rapid transportation. But why all this complication? Why not an airplane or a ship service between the points bridged by this elaborate structure?

Microscope and Telescope Too

With one instrument you can either see the mountains on the moon or magnify a spider to the size of a cat

By P. J. Risdon

English Correspondent of the Popular Science Monthly

SUPPOSE that there were an instrument that is both a telescope and a microscope. Suppose that at a distance of twenty-nine feet you could with its aid read small print in a dictionary, or see the individual hairs on a mouse twelve feet away, or identify plants on a wall a quarter of a mile off.

All this the wonderful Davon micro-telescope does. To understand just how it accommodates itself miraculously to distance, you must understand the principle on which both the telescope and the microscope are constructed.

In order to realize the advantages of the micro-telescope we have to consider the limits of ordinary telescopes. Disregarding, as we may, complications and refinements, a telescope consists essentially of an object-glass at one end and at the other end an eye-piece that is but a microscope. The object-glass focuses the image of an object upon the microscope lens by which it is magnified. The proportioning of the parts limits the range of an ordinary telescope. A telescope designed for observing the outer planets would not be suitable for studying insect life at ten yards range.

The Davon Micro-Telescope

A microscope consists of one or more magnifying lenses, called the objectives, which magnify and project its enlarged image upon the eye-piece of the instrument. Every one who has used a powerful microscope is aware that an object can be examined under it only in a given plane. Consequently, specimens for examination have to be specially prepared. For instance, for the microscopic examination of metals, sections of the metal with perfectly flat surfaces have to be prepared and etched with acid. Other objects are prepared by flattening them out, or alternatively the focus of the microscope has to be frequently altered, to enable the different parts of the surface to be examined successively.

Now comes the Davon micro-telescope, a combination of a microscope and telescope. Range and depth of focus are obtained at one and the same time, which is absolutely impossible with either instrument alone. Turn it on the moon and you will see its mountains. Turn it on the

garden wall and you see a spider a few yards off magnified to the size of a large cat. To do these things, simply turn a screw.

Owing to the depth of focus of the micro-telescope, that is, its equal magnification, at the same time, of the different portions of an object, a fractured section of steel, or mineral, any object, in fact, is simply placed in position and examined with a magnification of from thirty to ninety diameter, at a distance of from one to three feet from the object. The depths of the cavities are brought into view, as well as the protuberances.

The instrument consists of an ordinary microscope to which is fitted an extension piece that is virtually the telescope, except that the microscope itself constitutes the eye-piece. There are two different extensions, known as the long- and the short-focus attachments. The long-focus attachment enables the instrument to be used for objects at any distance exceeding six feet, to infinity. Thus either the moon or an object on the other side of the room may be examined, the magnification being variable up to sixty diameters. The short-focus attachment is for microscopic observation at distances of from one to three feet. Each attachment consists of a tube fitted with an object-glass and a series of "stops" or holed diaphragms that have the effect of sharpening the image.

Any standard microscope can be converted into a micro-telescope by fitting either attachment into the rim. With the short attachment you can examine microscopically anything that, because of its size or shape, could

not be examined either with a microscope or a telescope.

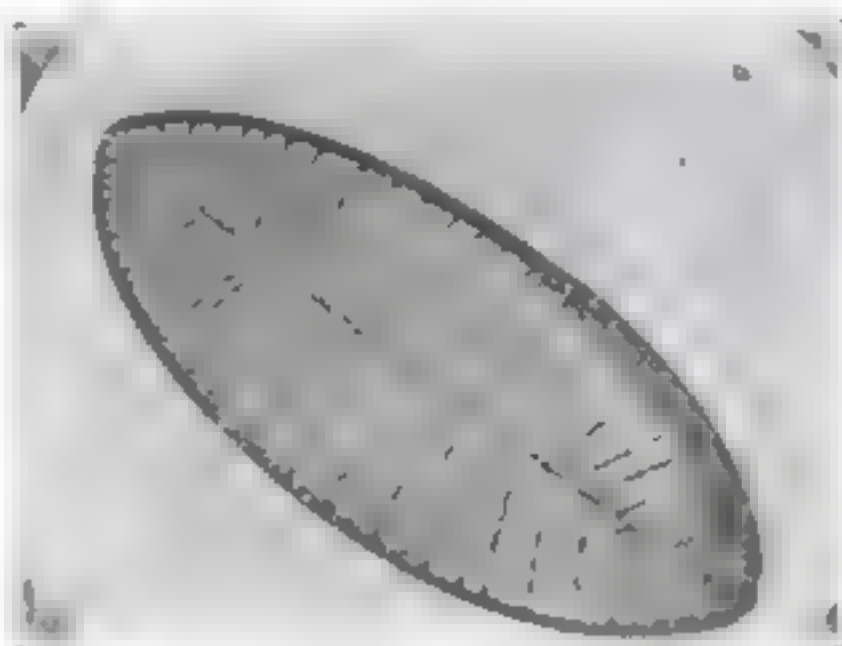
For mere examination of objects both near and far a self-contained instrument may be obtained resembling a small pocket telescope thirteen inches long. For indoor work this may be mounted on an ordinary stand, for field work it may be held like a telescope or mounted on a tripod, or screwed to a tree or post by means of a gimlet attachment. When used on an ordinary stand, a flat mirror clipped to the end of the telescope enables high angle views—for instance, the moon overhead.

A Camera Is Part of the Equipment

Whatever can be seen through the micro-telescope can be photographed. A camera forms part of the equipment. The eye-piece of the microscope and its tube are removed, so that the magnified image of the object is focused directly on to the ground glass.

The super-microscope (as distinct from the micro-telescope, in which the microscope magnifies an "air" image of a more or less distant object, which is formed on the plane of the microscope stage by means of the telescope lens employed) deals with an image formed in the air, of a near object such as a microscopic specimen. This "real" image is obtained through a microscope objective that takes the place of the telescope objective. The result of magnifying by a microscope the image formed by another is remarkable. The distance between the object and the objective is increased. Considerably great depth of focus is acquired, and not at the expense of the definition.

Further, about twice the magnification that any given microscope objective is supposed to stand is obtained by means of the super-microscope. By substituting a camera for the eye-piece tube and eye-piece of the microscope, photo-micrography is simplified. Photographs of metal fractures at life size, metallography up to fifteen hundred diameters, and photo-micrography to three thousand diameters has been taken in this way with most excellent results. In the fields of science and commerce the micro-telescope and super-microscope should prove invaluable to metallurgists, mineralogists, geologists, botanists, engineers, surveyors, doctors, and to the intelligent public generally.



A photograph of a diatom taken with the super-microscope, it is magnified three thousand diameters



Operator photographing distant mountains with the Davon Telescope Super Camera

Drawings by G. H. Davis. © Motest Publishing Co.

Photographs courtesy L. Davidson & Co.

The Telescope that Is Also a Microscope

In the wonderful new Davon micro-telescope, a telescope is converted into a microscope merely by separating the lenses and applying a microscopic attachment. When a camera is attached to it, photo-micrographs may be taken. Attached to a tree, as

shown in the center picture, it can be used as a telescope.

As a photo-microscope the instrument photographed the house shown in the detail picture at the right at a distance of three fourths of a mile. Compare the photograph taken by an ordinary camera

Two in a Side Car

THE motorcycle is the poor man's automobile. It is growing in use and popularity every year. The side car has increased its carrying capacity and added a touch of comfort for those who would like to ride without straddling the machine on a rear seat.

The side car, however, has always been a one-person outfit. Here is a side car built for two. There is plenty of room for the passengers to ride in comfort. The spring suspension gives the machine the riding qualities of a small automobile. It is not improbable that this side car will threaten the taxi's great popularity.

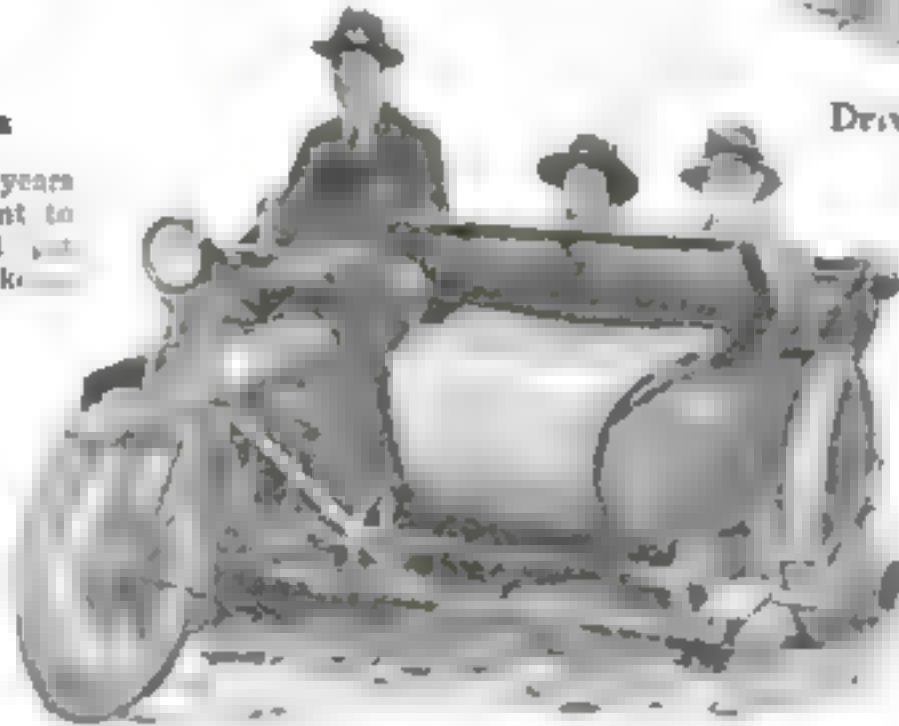


© Ewing Galloway

Seesawing on Wheels

WHEN children seesawed ten years ago, they were quite content to sing about Marjorie Daw and sit nowhere. Now, however, they like travel. And the result? The moving seesaw. It was invented by Carl Gehert, of New York city, and is shown here traveling down Fifth avenue.

As the boys on the ends swing up and down, the motion is imparted to gears that are connected with the large wheels. Thus, the faster the boys swing, the faster they move. There are wooden crosspieces mounted above the small guiding wheels that the boys use for "pushing off."



Driven by an Airplane Propeller

MORE than twenty years ago Count von Zeppelin built his first giant dirigible airship. To determine whether the propeller that had been designed would drive his airship at a certain speed, he mounted the propeller on a launch. The propeller churned, not water, but air, just as on a dirigible.

A queer vehicle recently made its appearance on the streets of Los Angeles. An automobile engine drives a large air propeller, which is enclosed in a kind of cage. The air-screw, by "boring" into the air, pushes the machine along, thus indirectly utilizing its power.

Eskimos Now Eat Cooked Fish

FEEDING fish to Indian and Eskimo children is one of the tasks of the Hay River Mission, located near Great Slave lake, in the northwestern part of Canada. The Indian and Eskimo children in the neighborhood are little savages and like their fish raw. But the missionaries are teaching them to eat it cooked.

The picture below shows how the fish are cooked.

Poles are driven into the ground, and pieces of cleaned fish are stuck on the ends of the poles. A fire of pinewood is built under the fish.

American Eyeglasses in Mukden

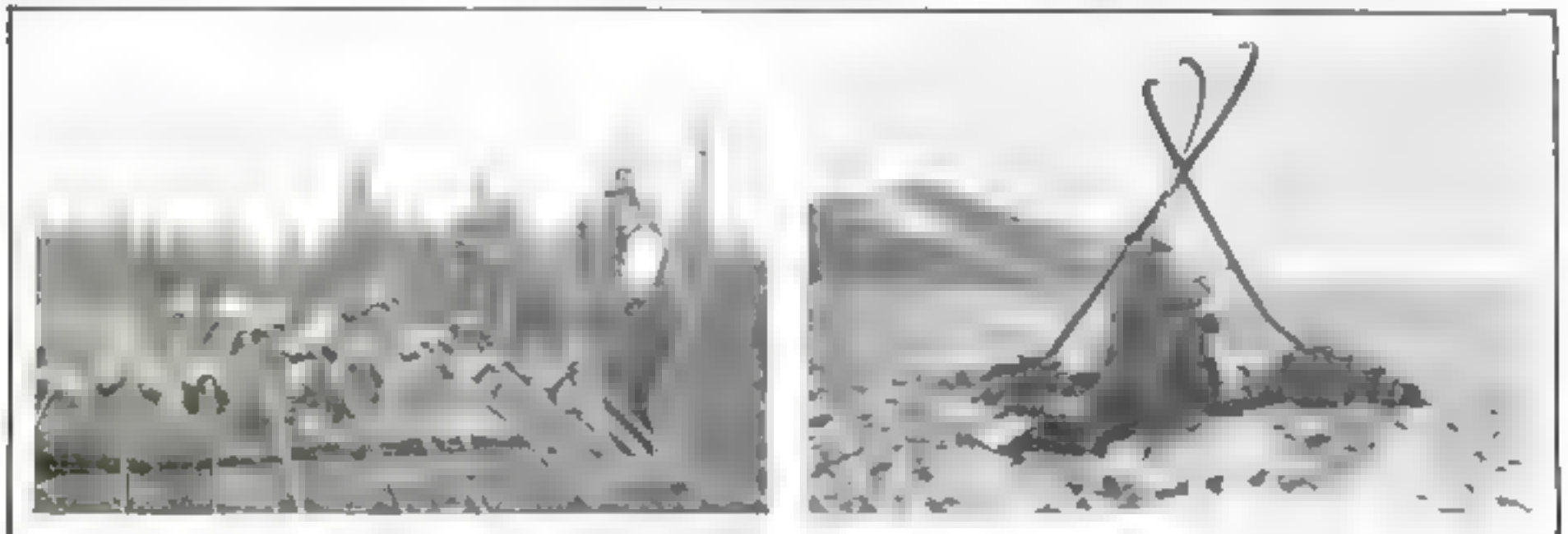
DURING the past few years—especially since the opening of government schools in 1907—there has been a large demand in Mukden for eyeglasses. The students, who form no small part of the residents in the larger cities, have taken chiefly to wearing spectacles. The violent wind-storms of the country also make goggles welcome as a protection from the dust.

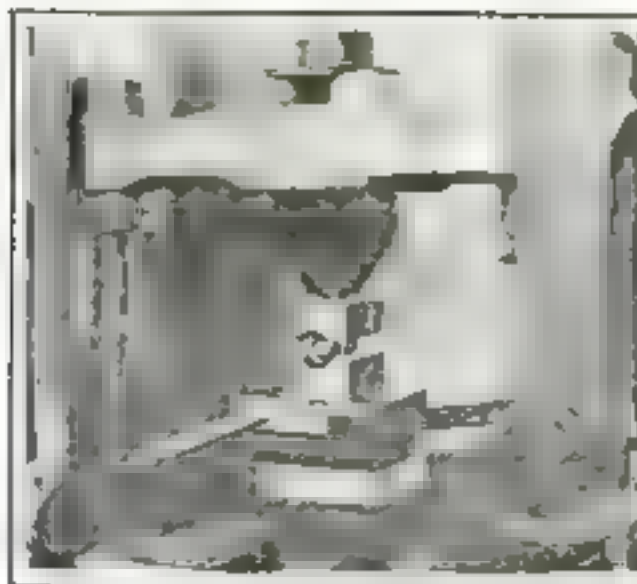
Most of the eyeglasses found in the Japanese shops are of American manufacture, which the natives seem to prefer rather than the small-lensed product that is manufactured by the Japanese.

"400 Miles to the North Pole"

IN books on polar exploration, authors are sure to tell you that "we erected a cairn to mark our position." The cairn is a kind of signpost, built of stones or wood from the sleds.

All these signposts are of interest, but this one especially, because it was built by the late Admiral Peary on that trip when he actually reached the Pole, after a struggle of twenty-three years. Captain Godfred Hansen, leader of a Danish expedition, stumbled on Peary's cairn, and no doubt found it useful. To him it meant "400 miles to the North Pole."





What Is "Still" Friction?

INQUISITIVE men of the Bureau of Standards, Washington, D. C., recently decided to make a few tests on the static or "still" friction of ball bearings.

Two large ball bearings were placed between two steel blocks. The blocks were then placed under a testing-machine, and a pressure of from five hundred to five thousand pounds was applied vertically. The friction present was determined by the force required to produce a lateral motion of the ball between the blocks as measured by means of a tubular spring balance.

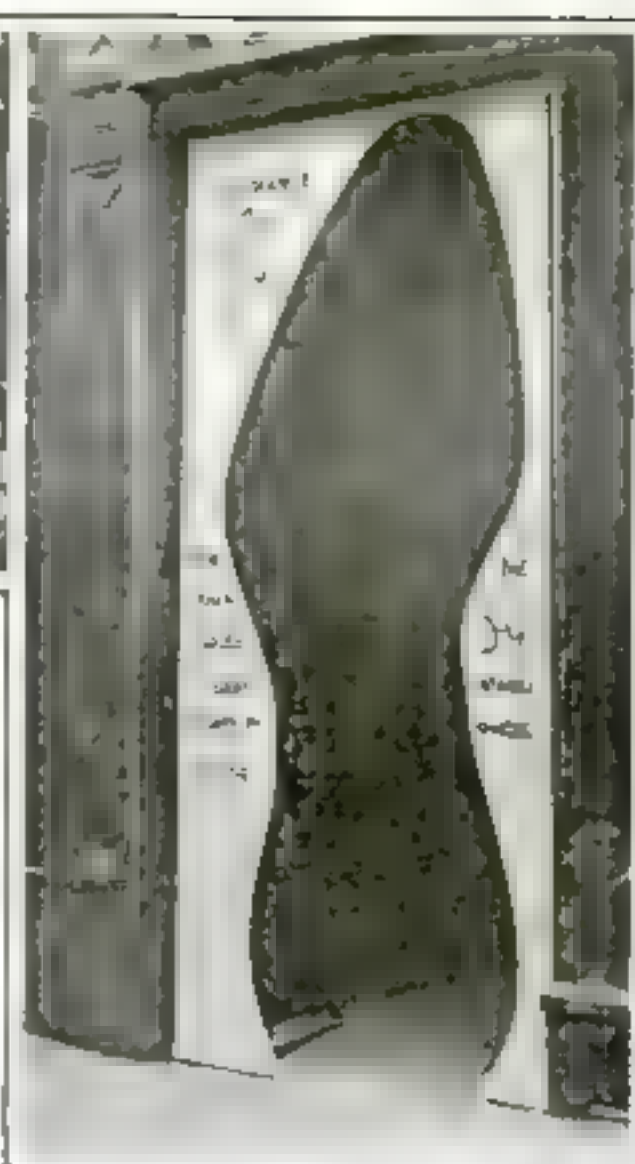
Various forms of raceways were cut in the steel blocks, and ball bearings of different sizes were employed. Two rollers were placed under the lower testing-block to add stability and to prevent the arrangement from falling out.

Playing Football on Bicycles

DICTIONARIES say that a football is a large India-rubber ball encased in leather. Such were the footballs of earlier days of the game. To-day they are built on the plan of automobile tires, and, while encased in the same tough material, they are not solid cores of rubber, but are inflated.

The great pressure exerted on an automobile tire shows how strong is a cushion of compressed air. Here, in the new adaptation of football, no such pressure is exerted. The front wheel of the bicycle is used to send the ball toward its goal.

In this game, one can imagine what a tangle of wheels must occur when a number of the riders rush together at an exciting moment, although it is doubtful if it is as dangerous as either Association or Rugby football, which each have a long list of victims to their credit. But what is a bump or a sprain to a good outdoor game of any kind?



© Krynose View Company

"Entrance for All Soles"

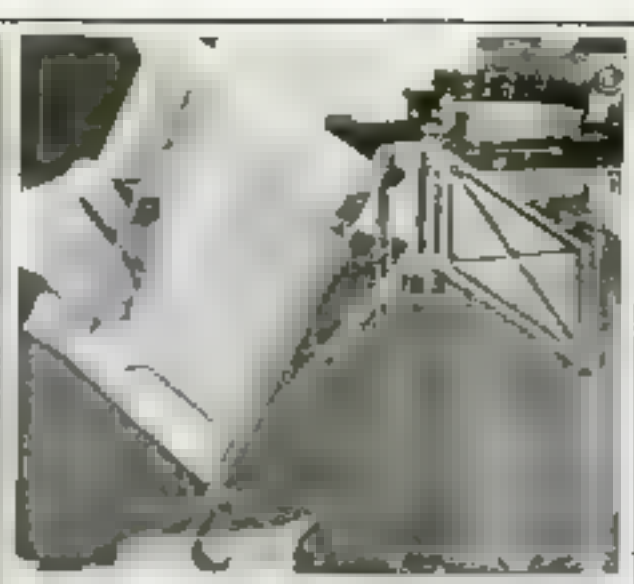
SO reads the sign that appears over the doorway of a New York store. You wonder at first whether the owner really means "soles" or "souls," and then you notice that the doorway itself is cut in the shape of a sole.

The store is one in which shoe-repairing and shining are done. And the sole-shaped entrance is cut out of white cardboard. It is very noticeable and has attracted many people to the store—which was exactly what the owner wanted. The canny storekeeper made other plays on the word "sole," as you see.

Saving Helium for the Future

ACCORDING to Richard B. Moore, chief chemist of the United States Bureau of Mines, the United States is richer in helium than any other country. She is taking steps to conserve the supply, having built two plants, one for experimentation and the other for extracting helium from the natural gas.

Helium is valuable in filling balloons and dirigibles. It is non-inflammable, and therefore safer than hydrogen.



It Holds the Telephone-Book

'WHERE'S the telephone-book?" Most of us have asked that question many times. Telephone-books should have a fixed place in the world—especially in the world of business.

In the picture above you see a new holder that can be fastened to the side of your desk. It keeps the book entirely out of the way when it is not in use. Yet, when you wish to look up a number, all you have to do is swing the holder to your side and raise the curved handle at the bottom. The book will automatically open as you raise it to a horizontal position.

On releasing the handle, the holder will lock itself in that position and remain there until you have found your number. Then you press a small button near the handle.

Is He Dead or Alive?

THE Nubian crocodile, like his companion of the jungle, the lion, is reputed to be the most vicious of his species. The captive shown in the picture below is a fine specimen of those that frequent the Ganges river in India, where they were considered sacred and were treated with respect and awe, even to the extent of the natives flinging their babies to them as a fitting sacrifice to the river god.

Millions of years ago crocodiles were undoubtedly native also to England and France; their remains have been found in fresh-water deposits and near the mouths of supposed rivers.

This specimen is dead, though he is to all appearances very much alive. The photograph was made by James R. Eaton, of Maplewood, New Jersey, who has spent many years in the wilds of Africa.





Mount the Flashlamp in a Holder

THE handy little flashlamp becomes handier when it doesn't have to be held in the fingers. To train the light on a certain spot, yet have both hands free, is an accomplishment afforded by the metal clamp recently invented by William Waegel, of Reading, Pennsylvania.

The holder can be attached to almost anything, or it can be laid on the ground and the light turned in any direction. Not only can a flashlamp be used in the holder, but it can be used to hold an ordinary electric lamp.

The holder consists of a metal clamp carrying a pivoting device.

\$30,000,000 in a Chair

IN the Shah's palace at Teheran may be seen the celebrated Peacock Throne, shown in our photograph, and valued at more than \$30,000,000. It was taken from the Grand Mogul at Delhi by the victorious Nadir Shah.

It is in many ways a curious and wonderful article, virtually a single chair, upon which the Shah sits when he holds diplomatic receptions. The wood is of the finest ebony, and most elaborately carved, and ornamented with sheets of gold on which are enamels, fantastic birds, and chimeras set with precious stones, culminating in a diamond sun.



© Keystone View Company

How Mount Vesuvius Looks through a Telescope

AN active volcano, such as Mount Vesuvius, is one of the most interesting spectacles afforded to the eyes of man. Like any dangerous cataclysm, its bursts of flame and explosions of "lava bombs" are safer to witness from a distance than near by.

Here the telescopic camera comes in with advantage. The photograph shown above was taken in September, 1920, through a camera equipped with a telescopic lens. The opening in the side of the crater, through which the smoke and poisonous gases issued, is more than a mile and one half in diameter. An observatory on a near-by ridge, supported as a national institution, has taken a continuous record of each phase in the eruptions of Vesuvius for many years.

When the wind is favorable, it is surprising how close one can approach the dangerous field of Vesuvius. But with a telescope one does not have to await the change of direction of the wind.



Courtesy of "Western Electric News"

Saturday Night in Japan a Serious Matter

WE have been told that the United States has more bath-tubs to the square mile than any other country; but even some of us can remember the Saturday-night lath in the kitchen. Crude as

it was, the old kitchen was comfortable in the warm glow of the fire.

Contrast with this the discomfort of taking a bath in Japan, as shown by the picture. Note the small stove and the drainpipe flue that releases the smoke just on a level with the washed one's head. The tub itself looks seamy, and the rough edge makes one shudder.

Taking a Vapor Bath

FOR administering vapor baths in conjunction with electric-light baths, and for controlling the apparatus at will, Winfred S. Clum, of Wilkinson, Indiana, has devised a cabinet equipped for ether gas, alcohol, or electric heat.

The boiling system consists of a supply tank that holds a gallon of water, which is automatically supplied to a boiling-pan.

The heating element is located within the heat-chamber. It is easily controlled.

The apparatus is used for the treatment of rheumatism, neuritis, neuralgia, obesity, blood-pressure, and various lung and bronchial affections.





Glue Made of Blood

MAN HAS FOUND a new glue from blood for use in welding airplane parts and in plywood exposed to moisture is an achievement credited to the Forest Products Laboratory.

The glue from blood is more waterproof than the casein glue now in use, a virtue that is especially desirable in the cleavage of woods exposed to the dampness of changing atmospheric conditions. The new glue will hold together layers of wood only 1/125 in. thick.

Dried blood albumin is received from the meat-packing establishments. Fresh blood can be employed only when the slaughterhouses and glue-manufacturing facilities are not far removed, for blood coagulates easily and decomposes.

This Egg-Turner Is of Simple Construction

EGGs for hatching are always collected in cold weather to avoid freezing.

The poultryman shown in this photograph has built a homemade device for turning the eggs when large numbers are being saved for hatching.

The illustration clearly shows the mechanical details of the turning rack. Trays expose the eggs to the warmth of the room, otherwise the eggs would require shuffling with the hands. The rack is a labor-saving device for handling eggs where there is a temperature of from 50° to 60° F.

If the collection is stored for only a few days, a turnover is unnecessary. Daily use of the turning rack is recommended by the United States Department of Agriculture if the eggs are to be retained in storage for a week. Ordinarily, commercial egg-cases will answer the purposes of a turning device.



© International Film Service

Practising Golf-Strokes in Front of a Mirror

THE ambitious beginner in golf nervously takes his stand, and swings at the ball with the grace of an old-timer. After the dust clears away, he finds the ball undisturbed at his feet.

The onlookers enjoy the show, while Mr. Beginner feels like crawling into the sand-box. A lot of embarrassment may be saved by learning to hit the ball indoors before any attempt is made on the links.

By practising in front of a mirror, the beginner can train himself to really hit the ball. When he does hit the ball, a big net catches it.



Carriers that Preserve Fruit

BANANAS become discolored when bruised and the discoloration spreads; hence the banana becomes uneatable.

Frank Schmitz has invented a banana carrier that guards the fruit from harm. It consists of a burlap sack that is fastened to the inside of a cylindrically shaped crate. The inventor tells us that this carrier can be used for at least a hundred trips.

The crate is made of elm strips held together by heavy hoops. The sack is sewed to the crate with twine at each intersection of each hoop and strip. The mouth of the bag is located well within the outside hoop. Thus the bananas inside the bag do not come into contact with any solid substance that might bruise them.



More Space in the Theater

A GREAT and noble act for suffering humanity was achieved by the man who invented this theater seat. Did you ever sit on the end seat in a "movie" theater and manage to see all of the picture? If you did, you had a wonderful piece of luck.

Suddenly, just as the villain is shaking the poor, defenseless girl, in comes a lady with five children to tie past you. The kids walk all over your new shine and then you try hard to smile cheerfully when the lady begs your pardon.

This new seat has an opening cut in one side. When people pass, it is only necessary to turn and place your legs in the opening. This leaves plenty of space for people to pass you.

The Ball Can't Drop Out of This Glove

"HE'S muffed it!" The crowd groans as the second-baseman fails to hold the fast ball that shot his way.

The speed at which the ball travels creates a cushion of compressed air in front of it. Thus, as it reaches his glove, the compressed air causes the ball to rebound.

Major Robert H. Young, of the United States Air Service, has invented a baseball glove that swallows this compressed air, creating a partial vacuum in the glove and eliminating the tendency to rebound. There are air holes in the padded palm to which flexible tubes are attached. These tubes have their outlets in the sides of the glove. There are valves at the ends of the tubes that prevent air from entering.





This Is an Electric Hair-Clipper

FOUR hundred and thirty clips a minute—that is the speed of this hair-clipper. The man who dislikes the "feel" of hand clippers sneaking up the back of his neck will certainly be interested in the sensation this machine will produce. It gives him a combination massage (because of the rapid vibration), and hair-cut.

A small electric motor attached to the handle of the clipper drives it. A worm reduction gear is used. The entire outfit weighs slightly more than a pound, so it behoves the operator to make haste.

Carrying a Dairy Aboard Ship

THE owner of a Swedish freighter decided to take a trip on his vessel. He wanted to take his children also, and the question of milk had to be considered. The children had to be supplied with fresh milk every day, so their father decided to take two cows.

A cowshed was built on the upper deck, and two good Swedish milch-cows were placed in it. They crossed the ocean with out suffering, and gave their full quota of milk each day.

The picture below shows that the cows had found their sea-legs and were at home on a sloping deck.



Fish Taken Alive to Canneries

ONCE herring are caught, they must be transported to the cannery. If the net in which they were caught were towed to the cannery, many fish would be dead before they reached their destination. If they are taken from the water and placed aboard, then it is necessary to handle them twice.

When this newly developed barge is brought into use, a great mass of fish may be transported to the cannery with ease. The stern of the barge is open. The sides and the bottom are covered with a heavy net. The net in which the fish are caught is dumped into the barge. The barge is then towed to the cannery.

America's Wealth in Poultry

ARE you eating more than half an egg a day? If so, you are getting more than your share of the product of the nation's poultry-yard.

According to a recent estimate, there are in the United States 599,000,000 fowls. These produce annually 1,921,000,000 dozen eggs, worth \$1,170,000,000.

The average value of eggs is one third that of corn, and half that of wheat, and the same as cotton.



For Setting Off the Dynamite

BLASTING machines have always been very heavy. Here is a small light one, weighing only three and one quarter pounds. It is so small that it may be placed in the pocket and carried from place to place.

When the handle is given a sharp turn, a momentary current of great strength is generated. This is sufficient to set off five or six charges of dynamite when they are connected in series.

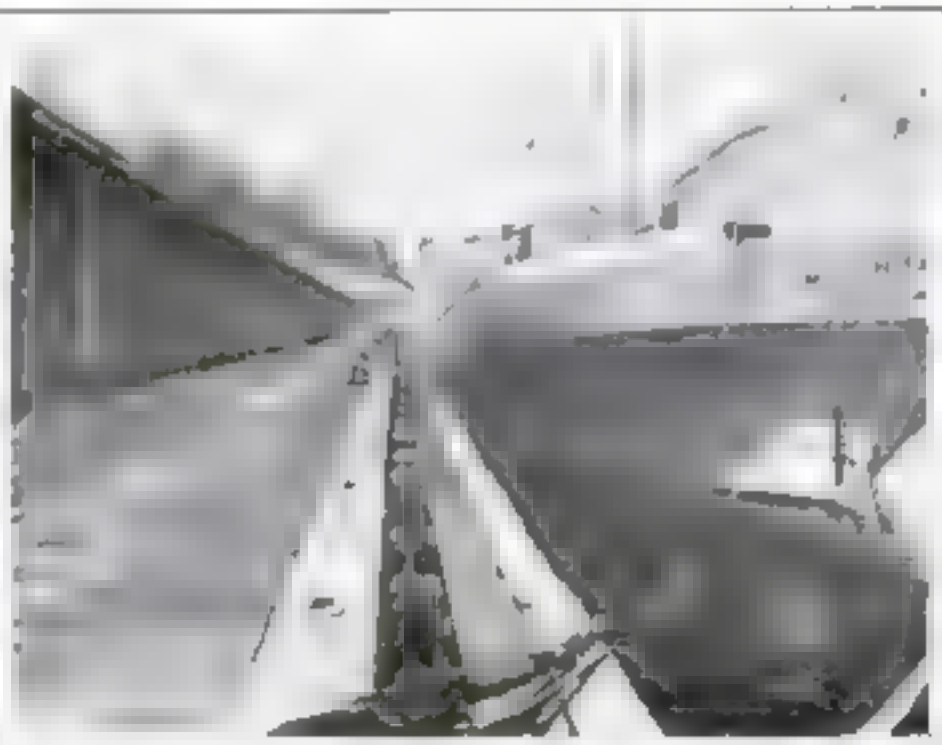
The little blaster is just the thing for the farmer. It saves the trouble of a fuse.

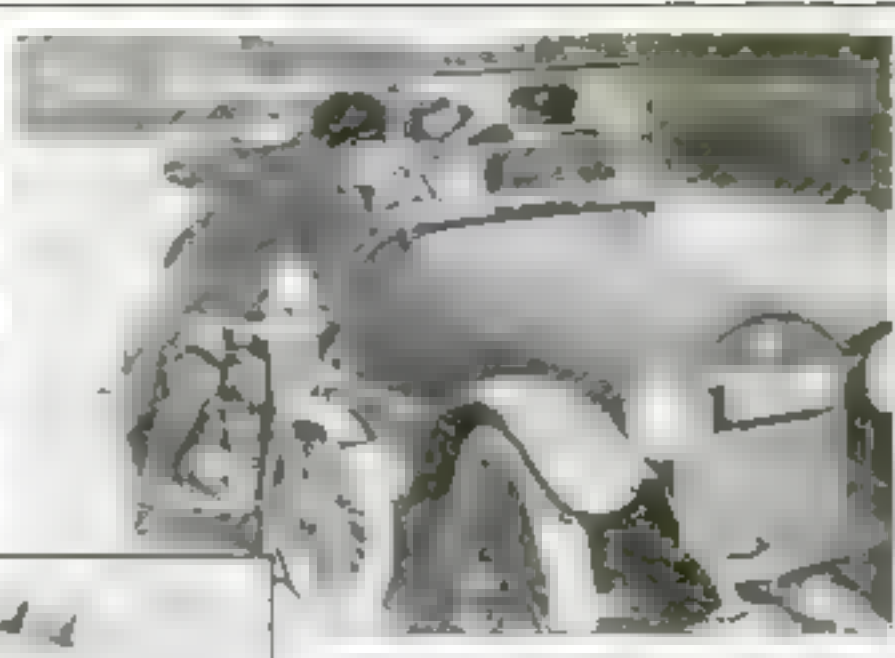
Shock-Absorbers for Piers

WHEN a 10,000-ton vessel "leans" against a pier, strains are set up in the pier and the vessel. The strains in the pier often result in damage.

An engineer of a shipping company in Los Angeles developed a pier shock-absorber.

A strip made of several large timbers is placed along the edge of the pier. This is separated from the pier by heavy springs similar to those used on the trucks of freight-cars. When a vessel bumps into this, all the strain is taken up by the springs, and damage to the pier is in this manner prevented.





A small new delivery

Smaller and Cheaper

YOU can get plenty of **motor vehicles** for four hundred dollars—but not new ones. **Small ones** that cost even less than that. It is a three-wheeler, the single wheel being in the rear.

It is very simply made and is consequently very light, weighing about one hundred and fifty pounds. The gears that move it are fully exposed to the public eye. In fact, so is the engine and the gasoline tank. Why, then, is there a hood in front? To keep up appearances, undoubtedly. As the gasoline feeds directly from the tank to the engine, there is no need for a vacuum system that might easily get out of order.

The tank is a small one—holds about a gallon of gasoline—and is attached to the back of the driver's seat.



Save Your Safety-Razor Blades

ONCE again that cast-off safety-razor blade fills a long-felt want. This time it goes into the making of a handy cigar-cutter—handy because it will fit a man's vest pocket.

The construction of this cigar-cutter is very simple. Two pieces of paper-maché cover the blade, which is held in place by an eyelet. In the center is the hole that accommodates the tip of the cigar.

There is a safety catch at one end of the cutter.

Hooking the Motor-Car Speeder

A CALIFORNIA speed cop is constantly on the lookout for motorists who are exceeding the speed limit or otherwise transgressing the rules of the road.

When he spots a driver who is not pursuing the even tenor of his way, he gives chase on his motorcycle. If the car-operator refuses to stop on command, the officer speeds up—sometimes sprinting at a fifty-mile-an-hour gait—until he comes alongside the fleeing motor-car. He hooks one end of a short tie-rope to the automobile, the other end of the rope being secured to the handle-bars of the motorcycle. The rope is just long enough to hold the bicycle against the running-board so that it coasts along and permits the officer—if necessary—to step from his seat to the running-board.



Lightning Punctures a Pavement

THIRTY-FIVE thousand volts will enable a current of electricity to jump across an air-gap of one inch.

The average bolt of lightning, which is purely an electrical discharge, is about one mile and a half long. How many volts does it represent? Several trillion volts is about as close an estimate as can be made.

This terrific discharge has a powerful rupturing force. Evidence of this is shown in the photograph. The stroke of lightning bored a hole in the pavement about one half inch in diameter and continued on its way. A high heat is generated at the instant of impact that may reach several thousand degrees, and it is well not to be standing near

Why Not Take Your Music Comfortably?

DIVANS of today are enormous pieces of furniture with very wide arm-rests at the ends. Why not put these arm-rests to use?

A Western manufacturer suggests building a phonograph in one and a case for records in the other. Neither phonograph nor record-case can be seen unless the tops of the arm-rests are raised, as shown in the picture below.

The sound-box of the phonograph has its opening in the front, but it is covered so that it is not noticeable. The record-case will hold one hundred and twenty-five records. Thus you can play that many records without getting up.

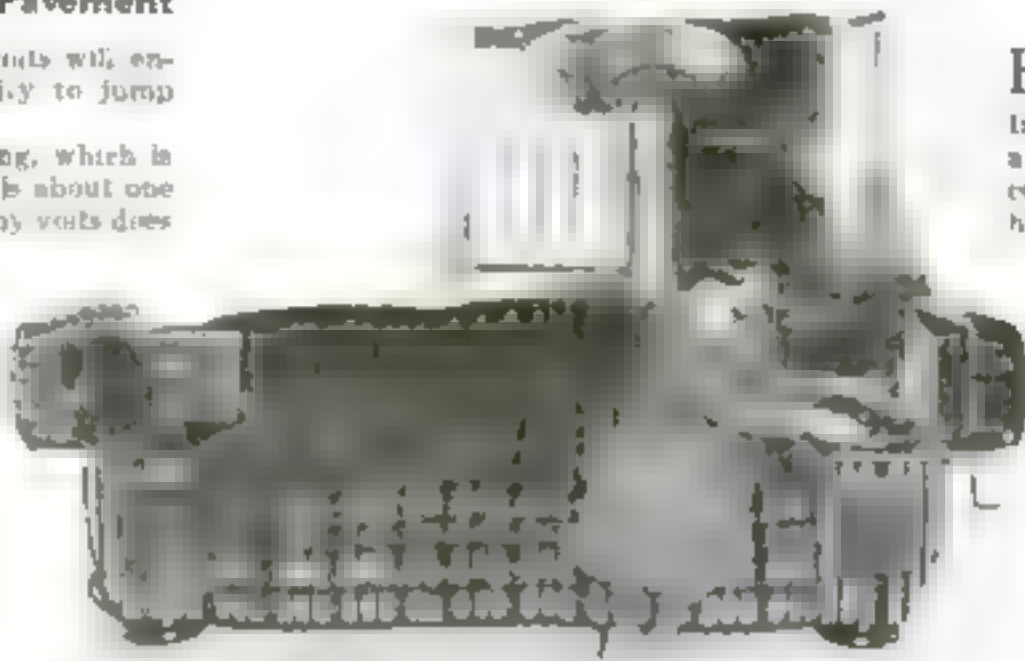


No Puddle Here

HAVE you ever had on a nice clean pair of white shoes and tried to get a drink of water from a public fountain located in the center of a big puddle? Well, here is a little idea that will avoid

the formation of a puddle by taking care of the overflow. This very simple device has saved a certain municipality the expense of installing an expensive drainage system, also the inconvenience of ditches in the city streets.

A large piece of tile pipe is placed around the fountain and the space between is filled with sand. The water flows into the sand and seeps away into the ground.



Some Ways to Save

H. C. Rowell, winner of the first prize in the Popular Science Monthly's Step-Saving Home Contest, constructed a hydraulic lift to bring coal from the cellar. G. Benders, winner of the

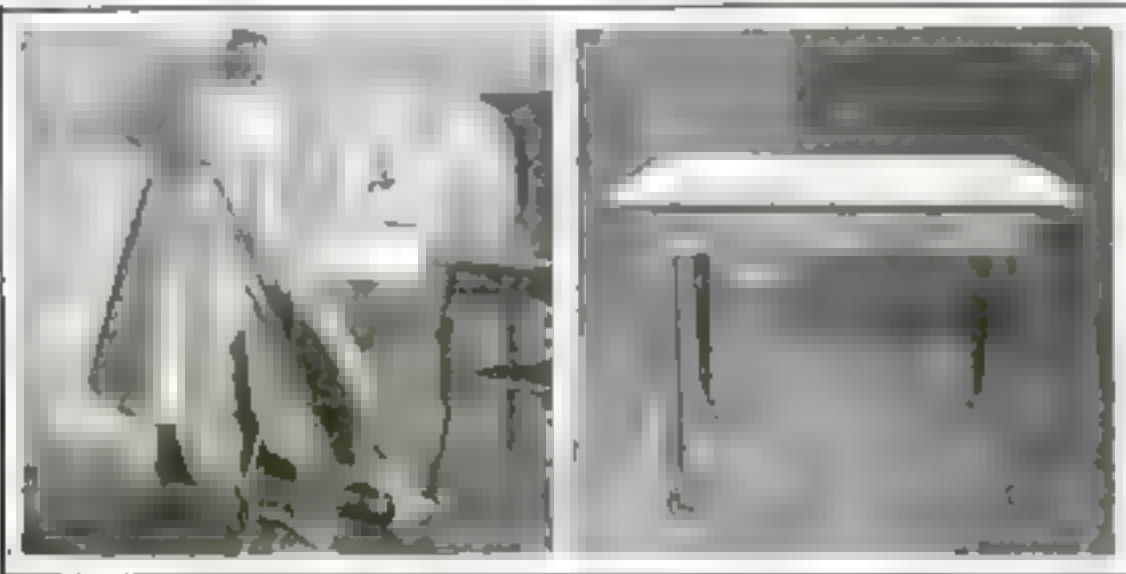


A clever idea! Walter R. Rousar, a reader of Popular Science residing in Schuyler, Nebraska, has placed a drawer in the staircase. In this, his wife places all the linen used downstairs. A good step-saver.

Mrs. George L. Patterson, of Davenport, Iowa, has arranged a faucet near her gas-stove to save her the labor and the steps necessary to carry the heavy wash boiler from the sink across to the stove.



This idea will save steps and labor. The coal hod and the wood box are placed on casters. The hod may be rolled eliminating much lifting.

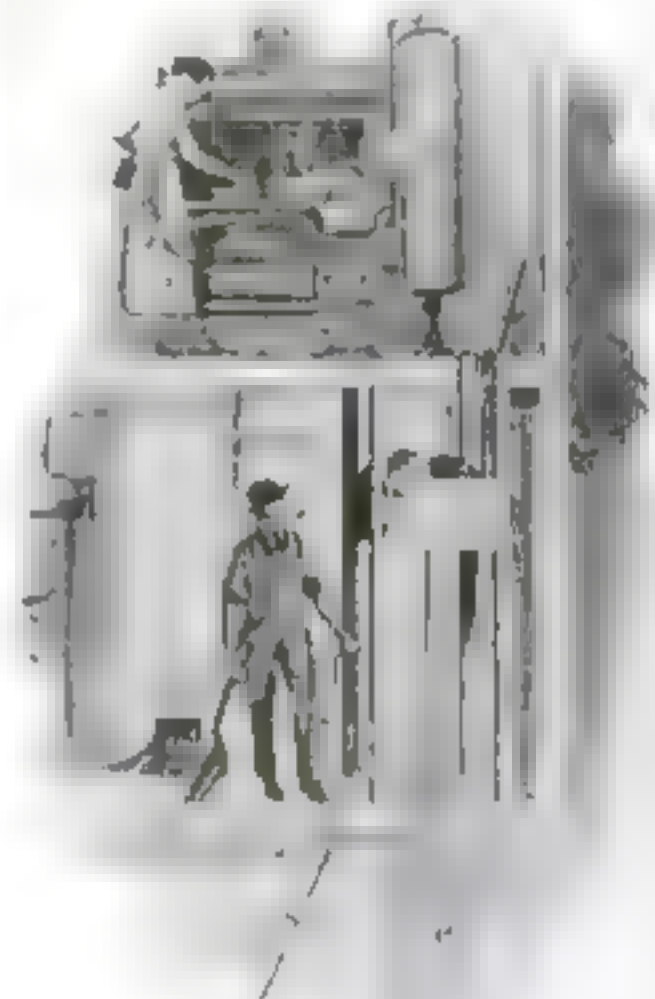


Not necessarily a step-saver, but a labor saver the vacuum cleaner quickly dries the kitchen floor. The second prize of twenty five dollars was awarded George Benders, of Jersey City, New Jersey, for this.

Wheels on the kitchen table enable the housewife to move the table to her work instead of taking her work to the table. Winfield M. Bayer of Hartford, Connecticut, is responsible for this simple, common-sense idea.



C. E. Caldwell, of Birmingham, Alabama, finds this idea saves him many a weary step when he is doing the garden chores.



Here is the idea that won the first prize of fifty dollars. H. C. Rowell, of Hudson, New Hampshire, suggests installing a simple hydraulic lift to carry fuel from the cellar. The city water system has plenty of pressure for this use.

Steps in the Home

second prize, found that the vacuum cleaner will dry the kitchen floor. C. R. Trimble, a New York top-floor-apartment dweller, meets the milkman every morning with a hoist



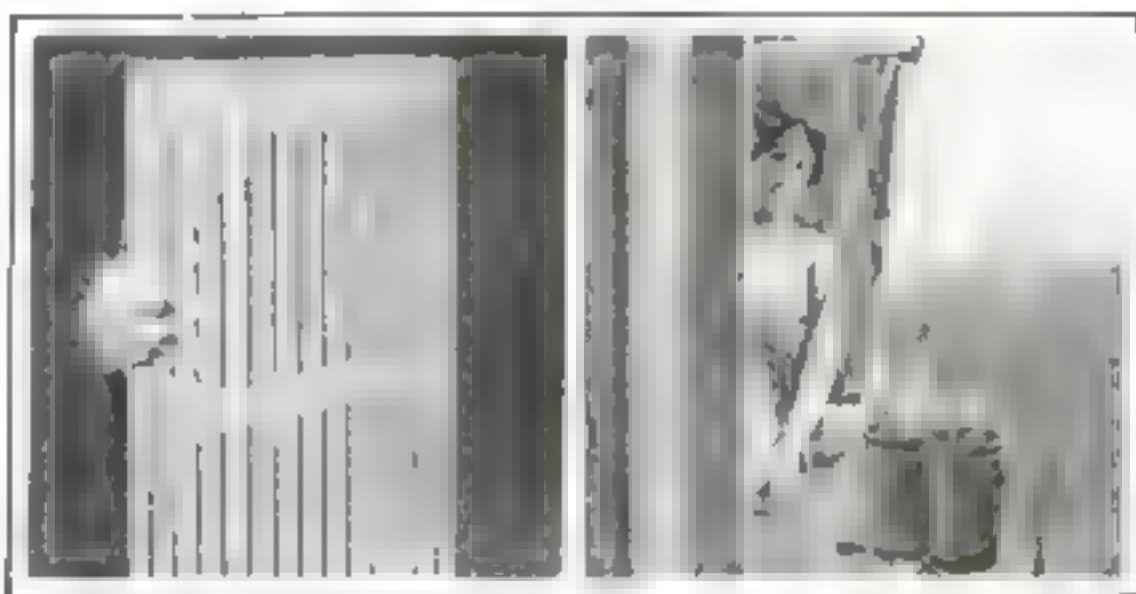
A board attached to the gas-stove accommodates the kitchen utensils where they are needed. E. O. Eggenasperger, of St. Paul, Minnesota, entered this idea



Mr. E. O. Eggenasperger has found that to be a real step-saver. She has brought an old bicycle wheel into use as a pan and kettle holder. By simply revolving the wheel she can take down any kettle or other utensil without moving

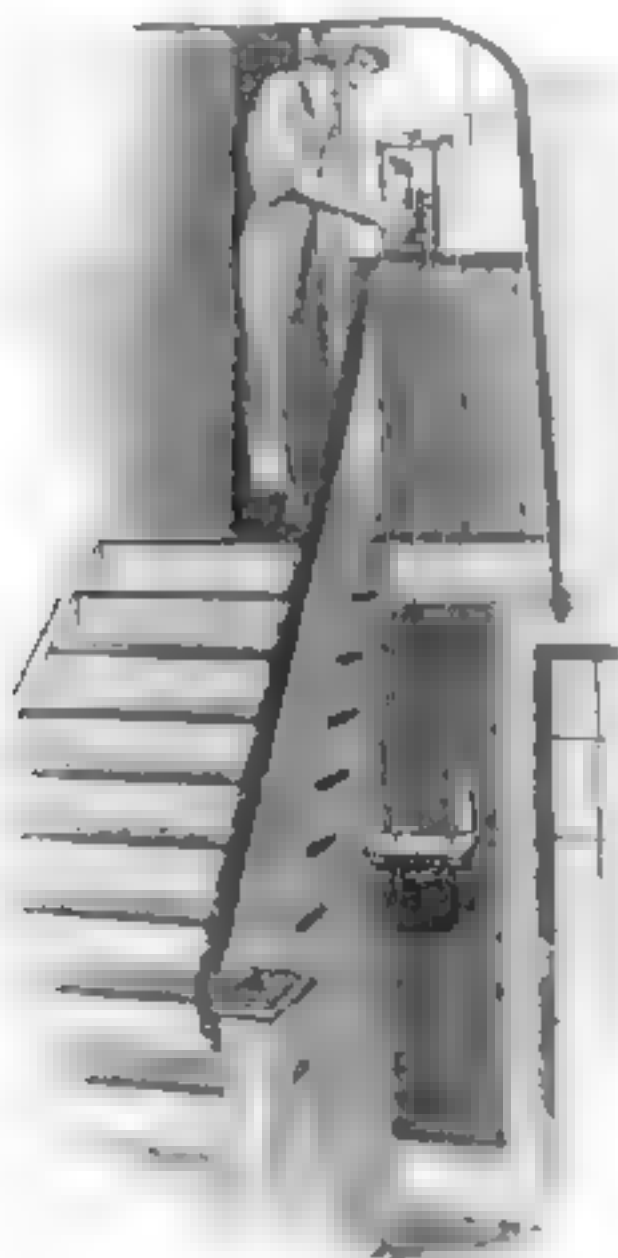


Do you know what is in your attic? Keep a list of the things you put away. Consult it when you are searching for some article that promises to be useful

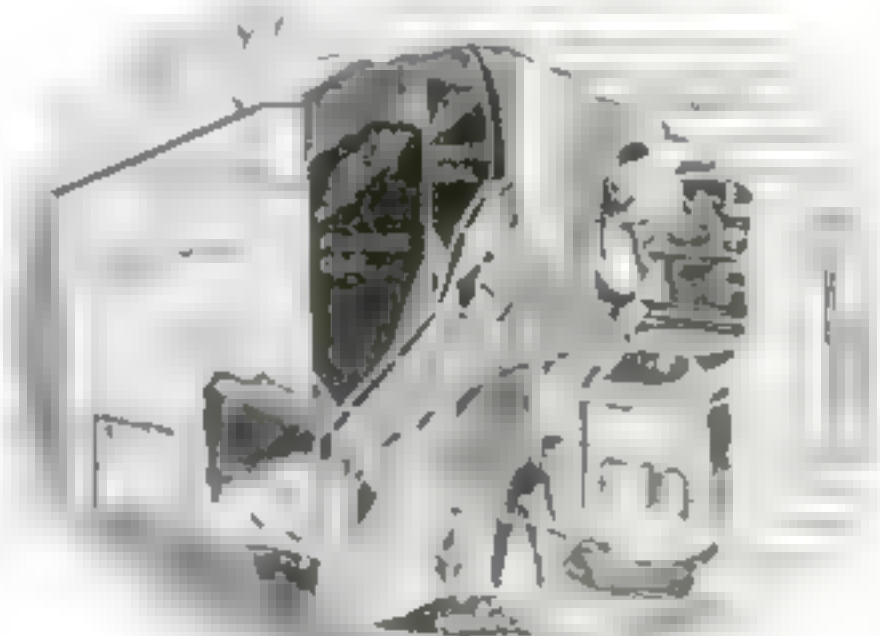


It looks simple, but it does the trick. The sponge absorbs the water from a leaky valve. The water evaporates from the sponge and helps to keep the room at the proper degree of humidity

C. R. Trimble, of New York city, won the third prize with this idea, which will be appreciated by people living above the first floor in apartment houses. He meets the milkman every morning with this hoist



A single telephone for both floors. This is the idea of George Lee, of Chicago. It saves steps and time. Any good home mechanic can install the device in a few hours and by this means save many steps for every member of the household



S. Benam, of Calgary, Alberta, Canada, built an outside coaling that serves the furnace and the stove and takes the steps out of delivering coal

Do It with Tools and Machines



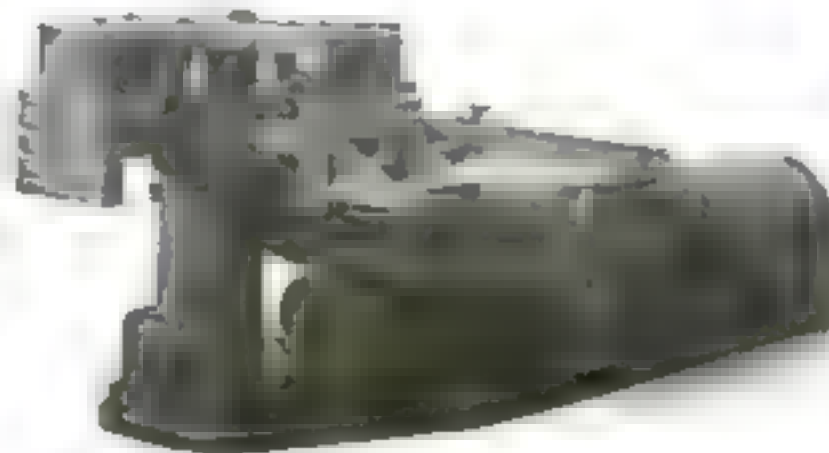
The new wire drawing machine, which is a great improvement on the old type, will draw wire at high speed and accuracy will be acquired with the use of this new machine.



In big rotating wire drawing machine, the freshly drawn wire from the spools has always been a problem. Now the wire may be drawn at high speed and accuracy will be acquired with the use of this new machine.



Wind absorbs moisture, and moisture causes a warp. This warping may be prevented by using aluminum leaf aluminum beaten out into very thin sheets is used to cover the expensive wooden patterns. It prevents the absorption of moisture.



A horizontal disk grinder that will keep one man busy feeding it. It has four vices, which revolve on a swivel. While one casting is being ground, the operator is attaching another.



The new wire drawing machine, which is a great improvement on the old type, will draw wire at high speed and accuracy will be acquired with the use of this new machine.



Here is a rough boring and mulling machine of new design. The boring spindles are mounted directly opposite the mulling cutters. The revolving table is driven by compressed air.



The new wire drawing machine, which is a great improvement on the old type, will draw wire at high speed and accuracy will be acquired with the use of this new machine.



A portable boring bar that bores cylinders on the job. It is at work here boring out a steam engine cylinder. It is attached to the cylinder with clamps.

Keeping Up with the March of Science

Facts for the man who wants to know

Something New in Soil

A NEW soil substance has been discovered by the United States Department of Agriculture. It is a gelatin-like material that is very plastic when wet and resembles resin when dried. It has been named "ultra-clay."

When analyzed, it appears to be a silicate of alumina combined with iron, potassium, sodium, magnesium, and calcium. The ultra-clay has been added to loose sand when moist, and made into briquettes, on drying, it has become tremendously strong. Yet, when the briquettes have been put in water, they have fallen to pieces.

The Department of Agriculture is making a detailed survey of soil all over the country. At present one third of the land has been investigated. However, since mountain and desert land will not be utilized for agricultural purposes at the present time, this part of the work can be eliminated.

Eat and Grow Hair

"EAT and grow thin" is a slogan that may soon be supplanted by "Eat and grow hair." Internal application, it has been found, will make sheep's wool grow quicker, longer, and stronger. If keratin, a substance in the body that forms the chemical basis for hair—is duplicated as far as possible and fed to sheep, their wool will increase.

Mr. N. Zuntz, the chemist who has been experimenting with keratin derivatives, tried them on himself and found that his hair responded. Both the hair on his head and in his beard grew faster and thicker. However, if this sort of thing were carried too far, the keratin-eater might find himself turning into a gorilla-like creature.

Why Not More Parachutes?

ONE of the officers of the R-34, the historic dirigible that crossed and recrossed the Atlantic ocean in 1919, recently made the statement before the Royal Aeronautical Society in London, that during the war 750 English officers and 800 Frenchmen had saved themselves from burning observation balloons by means of parachutes. Had the war lasted longer, said Commodore Maitland, all aircraft would have been equipped with parachutes.

How does it feel to drop a mile or two through the air from a dirigible, or even from a lesser height when an observation balloon has been shot to pieces? The sensation is unpleasant, says Commodore Maitland, but the experience is not dangerous. Some men prefer to dive head first, and some to drop feet first. The anxious moment comes when landing.

The parachutist never knows on what he will alight. Trees prove a safe enough bed in summer, when they are covered with

fouage, but they are "horribly spiky" in winter. The sea is positively delightful to land upon—"like jumping on a feather-bed, only nicer," according to Maitland. How hard do you land? About as hard as when you jump four to five feet.

After these revelations there seems to be no very good reason why every flying-machine and dirigible should not be equipped with parachutes.

Don't Waste Gas

LARGE gas-bills are sometimes caused by unsuspected waste on the part of the consumer. According to a paper issued by the Bureau of Mines, 80 per cent of the gas received is wasted.

How does this happen? In many cooking and heating appliances the position of the gas flame is incorrect. In cooking, the point of the flame should touch the pot. If it does not reach that far, heat is wasted and if it licks the sides of the pot, gas is wasted.

Then again, if the mixture of gas and air is incorrect, a yellow flame will result. This contains very little heat and will turn the pot black. A non-luminous blue flame contains the greatest amount of heat.

Saving Old Red Corpuscles

DIPHTHERIA serum and many other serums are made from the fluid part of horses' blood. A healthy animal is bled, about thirty-six quarts being taken from it in a week, and the blood is allowed to stand until the red corpuscles have settled at the bottom. The fluid is then drawn off, and the red corpuscles thrown away.

Dr. W. J. Penford, director of the Australian Commonwealth Serum Institute, considered this a tremendous waste, and he tried injecting the red corpuscles into the horses again. The result? The horses are able to form corresponding fluid rapidly, and a greater amount of blood can be removed from them. Instead of thirty-six quarts, forty-eight quarts can be removed in a week. The composition of the blood is not affected by this forced formation.

Rain the World Over

WHAT happens to rain after it falls? Some sinks into the ground, some evaporates, and some drains off through rivers into the sea, carrying tons of solid matter with it.

In actual figures, 29,347 cubic miles of water fall on the earth in a year. And as one cubic mile of water weighs more than four billion tons, the total weight is enormous.

About one fifth of the total rainfall is carried into the ocean, and it takes with it almost three billion tons of solid matter.

Leather from Yeast

"TEN parts of yeast containing fifty per cent water"—when a recipe calls for yeast you immediately think of "home brew." But in this case it has to do with synthetic leather and rubber. The yeast is mixed with one part of glycerine and six tenths part of tar. When this is properly mixed, six tenths part of glue is dissolved in it, and the whole is treated with formaldehyde, heated, and pressed into molds when hot.

If rubber is desired a low pressure is exerted, whereas if leather is desired a high pressure is exerted. A very slight pressure results in a soft material like Para rubber.

How Worms Taste

"ANIMATED noodles" is the term applied to one of the favorite dishes of the Mono Lake Indians of southern California. They are literally the kind of worm that little Willie adjoined to the garden to eat.

Dr. J. M. Aldrich, of the National Museum, ate some of this food, and he describes it in the following language:

"They taste like linseed oil. When properly prepared, they look something like a date, but the color is slightly more pungent."

We are not clear as to what the doctor means by "properly prepared," but we feel almost sure we would not like them.

Turning Sewage into Power

FROM Australia comes a plan to generate a septic gas from the sewage of towns. The British Ministry is investigating the claims of the inventor as to the yield from this source.

Analysis of the gas shows that on an average it consists of 60 per cent methane, 17 per cent nitrogen, 8 per cent hydrogen, 14 per cent carbon monoxide, and 1 per cent oxygen. Experts declare that there is no reason why, properly controlled, advantage should not be taken of the bacteriological action of sewage in septic tanks.

Tests made to determine the horsepower developed in engines resulted very successfully.

Don't Destroy the Vitamines

A BRITISH physician recently put forth the novel theory that one of the causes of chronic malaria is a diet containing an insufficient vitamin content. In his opinion, British housewives are too much addicted to boiling vegetables, and even fruit. Overboiling destroys the valuable vitamins. He points out that the French thrive on raw fruit.

Members of the Lister Institute working

among the undernourished children of Vienna ascribe to the same cause an epidemic of scurvy. Although sufficient vegetables were provided to supply vitamins in the proper amounts, the epidemic was unabated. Investigation finally placed the responsibility on overcooked vegetables and the dietitians recommended steaming.

What Alcobronze Is

POSSESSING the luster and color of gold, stronger, tougher, and harder than ordinary bronze, a new alloy of copper and aluminum bids fair to have a wide use. The new metal has been named alcobronze.

It is stated by its sponsors that the new alloy can be wrought, forged, or rolled without deterioration. It also resists the action of the air, acids, and salt water. This makes it particularly suitable for forgings, propellers, and other ships' parts.

Oil Shells to the Rescue

OIL thrown on the waves will calm them. Hence it has been suggested that oil shells be fired from life-line guns in the coast guard stations, to calm the waters around stranded ships.

If the oil shells are hurled well to the windward of a ship, and are made to explode on contact with the water, the oil will soon drift around the ship and make it possible for a life-boat to be launched in safety.

An ideal oil shell would be one that could carry a gallon of oil.

Clouds that Airplanes Make

AN airplane, flying high, will form a cloud. The temperature is very low, particularly at a height of thirty thousand feet. The atmosphere is often saturated with vapor, and it needs some disturbing influence, such as an airplane, to start clouds forming.

At Munich, recently, an airplane was flying at a height of thirty thousand feet. In front of it the air was clear but behind it formed an ice cloud thirty miles long.

Lost—Five Billion Dollars

THE indestructibility of the standard precious metals, gold and silver, is demonstrated, says Dr. George F. Kuhn, by the finding, at various times, of treasures of gold in earthen pots dating from five centuries before Christ, which are absolutely as they were when they came from the mint.

Gold and silver have been used for coinage for twenty-five centuries. There have been used at times, as mediums of exchange in various parts of the world, corn, rice, salt, coconuts, dates, shells, shark's teeth, and wampum, but these have had a local value only.

Up to the present time in the world's history, seventeen billion dollars in gold has been mined, of which five billion has been lost, leaving twelve billion dollars in circulation and in the arts.

Taking the Dust Count

HOW much and what kind of dust flies in the air of a particular industrial plant? This is a question that can be answered only by a minute examination of the dust, which is called "taking the dust count."

To determine how unhealthful the air dust of a particular plant process may be, after the composition is ascertained its effects are interpreted by standard tables prepared by the United States Public Health Service.

This knowledge is very important, inasmuch as certain amounts and kinds of dust seriously affect the lungs and predispose the workers to tuberculosis and other diseases.

Two Lives for Stationery

EVEN the best and most expensive letter-paper is considered worthless after it has been written on with pen and ink. It ends its existence in the fire or in the ash-barrel.

A German inventor, stimulated by the scarcity of paper of any kind in his country, has patented a method of reclaiming used writing-paper. The sheets are passed in rapid succession through four baths, the first consisting of 25 parts of water, $2\frac{1}{2}$ parts of oxalic acid, and $2\frac{1}{2}$ parts of glycerin, all by weight. The second bath consists of 25 parts of water in which one quarter of one part (by weight) of permanganate of potassium is gradually dissolved. To make the third bath, $2\frac{1}{2}$ parts (by weight) of acetate of lead are gradually dissolved in 25 parts of water. The fourth bath is a solution of sulphate of aluminum in water.

After the paper has passed through the four baths, the paper is squeezed between rubber rollers to remove the liquids contained in it, and is then dried and smoothed out, being run between hot rollers.

Crushing Germs to Death

HEA^T, ultra-violet light, ozone, and high-frequency currents are all death-dealing forces to microbes and bacteria. High pressure has recently been added to this list by Professor B. H. Hite, of the University of West Virginia.

When a pressure of 315,000 pounds is brought to bear upon a bacteria-infested substance, there is nothing left but a harmless mass of protoplasm. The application of this tremendous pressure in no way alters the taste of the substance treated, whether it be milk, cider, or grape juice.

No microorganism has yet been found that is capable of withstanding 315,000 pounds pressure; many perish under 100,000 pounds.

Professor Hite's mechanical process of sterilization is very simple. The germ-bearing substance to be treated is placed in a steel container or cylinder built to withstand the high pressure used. A piston fits into this cylinder, and the high pressure is applied to the opposite end of the

Milk treated with this germ-destroying process retains all its flavor. Pasteurization of milk brings about an unnatural

taste that is objectionable, and kills the vitamins without which disease would be produced.

While, from the laboratory standpoint, the system has been a success, Professor Hite is not sure at this time that his high-pressure process can be applied commercially.

The Perfect Climate

ARE health resorts healthful? Professor Robert D. Ward, of Harvard University, declares that it is fortunate for the general health that most of us cannot afford to visit the resorts.

He follows up this strange opinion with the following explanation. "The best climate for most people most of the time is one that has frequent moderate weather changes, fairly marked annual and daily variations in temperature, a reasonable amount of cold during a part of the year, a refreshing variety in the way of cloudiness, and sufficient rainfall to provide enough moisture for the growth of grasses and crops." Professor Ward confesses sadly: "There is no such thing as a perfect climate."

When It Rains Money

EVERY farmer knows that a drought destroys crops worth millions. But has the farmer ever calculated the money that is put into his pockets when the rainfall is abnormal?

One inch of rainfall above three inches in July increases the value of the corn crop by \$150,000,000 in Indiana, Illinois, Kansas, Iowa, Ohio, and Nebraska. When the July rainfall averages less than 8.4 inches, the yield of corn averages ten bushels less an acre than when it is more than 4.4 inches. The increased value is about \$250,000,000. The increase in the value of the wheat crop in the Dakotas, California, Washington, Kansas, and Nebraska is represented by \$15,000,000 for each inch of rainfall above four inches in May and June.

Now you know why the grain speculators watch the weather reports.

New Airship Fabric Needed

A ZEPPELIN airship, as every one knows, consists of a metal frame within which from fourteen to nineteen balloons, filled with gas, are caged. The frame is covered with a fabric that is translucent but not transparent.

A beam of sunlight can penetrate to some extent through both the outer frame fabric and the fabric of the inner balloons. The result is that the effect of a greenhouse is produced. In other words, the greenhouse acts as a trap for heat. And so it is with an airship. The gas is heated and expands. If the expansion is too great, it must blow off to prevent bursting of the balloon fabric.

Why has not some one devised a light woven fabric that is not translucent? Perhaps an opaque fabric could be produced. The fact that Edison has produced nickel thinner than paper, and had a book printed on it, suggests possibilities.

Samsons of the Twentieth Century



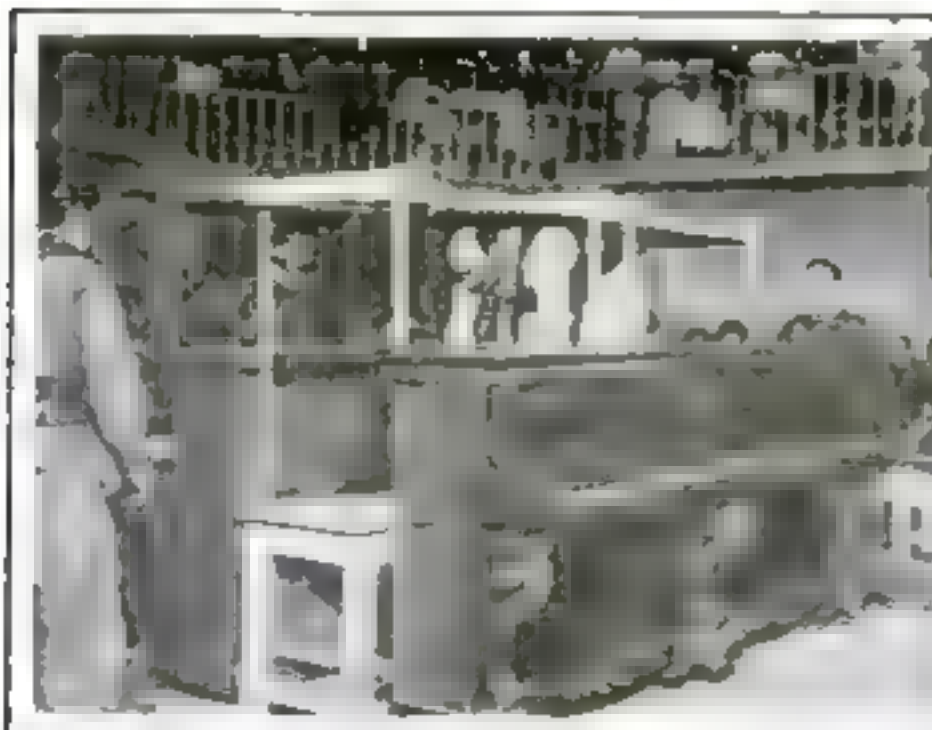
Herr Glasser, pride of the German circus, proves that he has more horsepower than the automobile to which he is tied. The motor is running in low gear, yet this man prevents it from moving.



Here's another strong man—Karl Moerke. Though he's short and stout, he is able to lift a four-hundred-pound weight with his shoulders.



Herr Glasser seems to enjoy being run over by an automobile. One of the occupants of the car appears more worried than he. Glasser finds it stimulating. How about his ribs? They are not even dented.



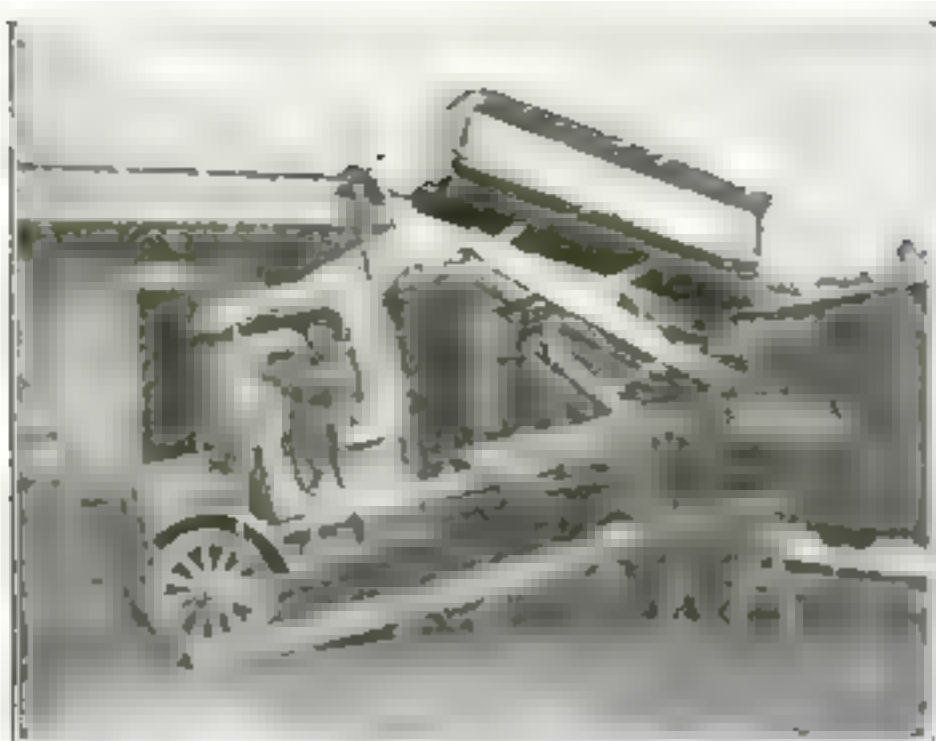
© Kaden & Herbert

Piano-movers are always husky individuals. It takes at least two of them to move a piano. Yet here you see M. Verhaert, a Frenchman, lifting four pianos—3000 pounds—at one time.



© International Film Service

James White, of Massachusetts, takes the bit between his teeth and pulls a touring car down the street. He wears a leopard skin across his chest to denote strength, undoubtedly.



With the help of runways, this new and simply operated dumping body is specially adapted to loading freight-cars.

It's Easier than It Looks

WITH the aim of making a few parts do the work of many, a motor-truck maker has developed a dumping body that can be tipped in the usual manner, or raised and tipped at the same time.

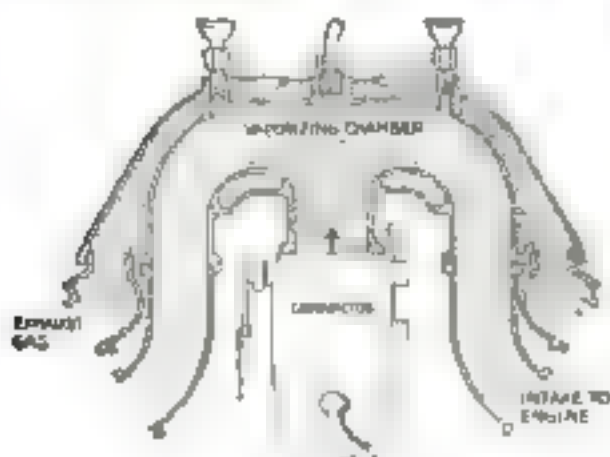
The new body is elevated by a hydraulic hoist, the additional elevating mechanism consisting of an extension elevating frame with a main elevating lever framework pivoted to the elevating framework at its midpoint and operated by pull rods and cables from the hoist.

A body of this type is especially adaptable for work where the load has to be dumped at a height from the ground, as in chuting coal into shed windows or hoppers, dumping concrete into mixers, or depositing garbage into tanks or vats.

Helping the Gasoline to Be Doubly Effective

ONE of the newest devices for vaporizing gasoline in automobile engines consists of an aluminum heat jacket that connects the carburetor with the intake manifold.

An opening at each end of the jacket connects with a like opening in each of the exhaust manifolds. With the first explosion of the engine, hot exhaust gases are forced through the jacket. The thin walls of the jacket allow the heat to be transferred to the gasoline, which enters the superheated vaporizing chamber and is drawn into the cylinders, a highly volatile gas.



This tilting headlight, designed to reduce glare, is tilted by the automobile engine. It is controlled by the driver from the automobile's instrument-board.



By utilizing the exhaust gases, gasoline enters the cylinders in the form of a volatile gas.

Rapid Mending of a Skid-Chain

REPAIRING automobile skid-chains has hitherto been done by hand with pliers and a hammer. A recently devised machine is almost automatic in action, and will insert a new cross-chain in place of a broken one in less than a minute. It is claimed that the machine and one man will do the work of six men without it.

The apparatus consists of two plungers mounted in a frame fastened to the top of a bench. The plungers are moved back and forth by a lever extending through the bench and operated by the foot of the mechanic. One plunger is sharp-ended, and serves to cut the link of the broken cross-chain where it connects with the side chain. The other plunger is blunt-ended and serves to close the link of the new cross-chain after it has been inserted into the side chain.

If you have kept account of time spent in mending chains, you will realize the value of this machine.



This little machine quickly inserts a new cross-chain in place of a broken one in less than a minute.

The Automobile Engine Tilts the Headlights

FORMERLY an automobile engine merely propelled the car. Later its power was harnessed to drive the generator; to charge the storage battery for lighting and starting; to drive an air-pump for inflating tires; to operate a horn, and to work the vacuum fuel-feed system. Now comes an inventor, Samuel F. Arbuckle, who makes use of it to tilt the headlights downward to eliminate headlight glare.

Each headlight is operated by a small bellows inside of the bowl of the light, the bellows being filled and emptied of air by the partial vacuum created in the engine by the suction stroke of the pistons, operated by a system of rubber tubing and copper piping leading from the bellows to the top of the engine-cylinder block and to a control lever mounted on the instrument-board.

The inventor of this new lamp has contrived to tilt the reflector portion of the lamp by utilizing the engine suction.

The movable reflector and its component parts may be operated and controlled from the instrument-board even when entirely removed from the lamp-shell and held in the hands.

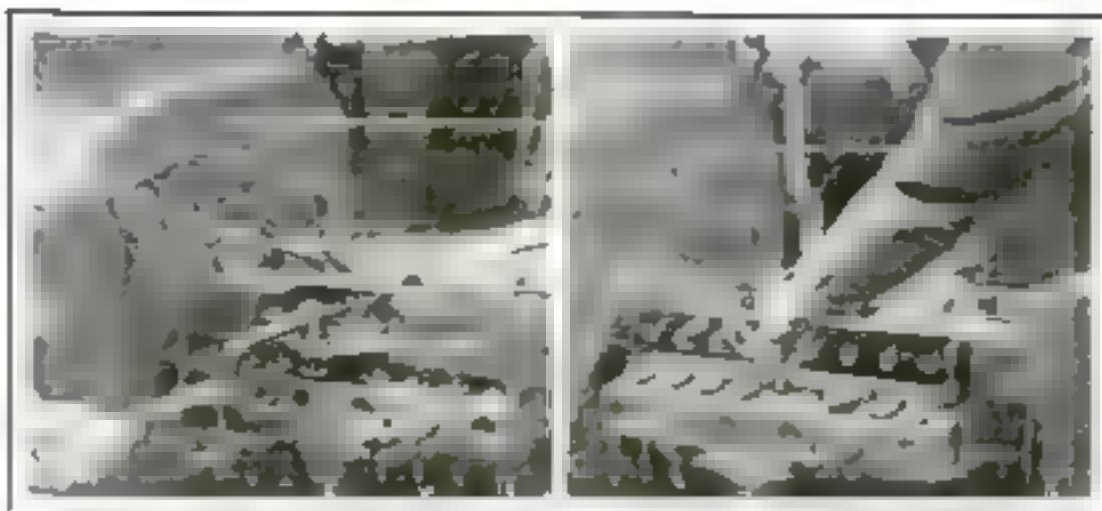
When in the tilted position, the lamps brilliantly illuminate a space twelve feet wide directly in front of the car with none of the dazzling rays of light extending more than forty-two inches above the level surface on which the car stands at a point seventy-five feet or more ahead. In the upward position, the lamps illuminate the road and the sides of the road for two hundred yards.

Grinding All the Ford Valves in One Operation

IF you have watched the mechanics in a Ford service station grind valves, you know that the usual procedure is to grind one valve at a time. With the use of a new machine all eight valves may now be ground at once. While the machine is made only for Fords at present, new designs for other cars are under way.

The apparatus consists of a framework carrying a steel-tooth rack, a series of eight bronze gears turned by the rack, and an operating handle to move the rack back and forth. After the cylinder head of the engine has been removed, the apparatus is fastened down to the cylinder block by means of dowel-pins and a clamping-nut on a hinged bar, which permits the framework to be tilted backward to examine the valves.

The eight gears are carried on short spindles surrounded by coil springs



Instead of grinding one valve of your Ford engine at a time, you can grind all at once with this little machine

Here the grinding machine is shown tilted back from the valves, showing the ends of the gear spindles

and having small disks with projections at their lower ends. Since the framework is turned upright about its hinge, these projections fit into the two depressions in the head of each valve. Then, as the gears are revolved about their axes by the movement of the rack, the valves are turned.

Before the grinding is begun, each valve is smeared with a coarse grinding compound, and an under-the-valve spring, twelve of which are furnished

with the machine, is placed under each valve.

While all of the valves are ground at the one setting, the actual grinding is not all done at the same instant, since only two of the valves will be down on their seats at one time. When the remaining valves are off their seats by reason of being pushed upward by the camshaft, the spindles of the gears are pushed upward against the

coil springs surrounding them and thrown out of mesh with the rack. Thus the machine automatically picks out those two valves to be ground and turns them on their seats so that the grinding compound actually grinds them in place.

After being ground, a half turn on the starting handle of the engine will turn the camshaft a quarter turn and thereby seat the two valves next in order to be ground.

Industrial Truck for Foundry Haulage

THIS electric truck for handling castings from the molds to the heat-treating ovens has the advantages of low operating cost, mechanical dependence, and great mobility. It is operated by a storage battery and makes about four hundred trips on one charge.

It carries covered pots of castings, weighing as much as four thousand pounds. These pots are picked off the floor and carried to the oven by an elevating platform at the front end of the truck and run by a separate motor drawing its current from the storage battery that feeds the truck-propelling motor.



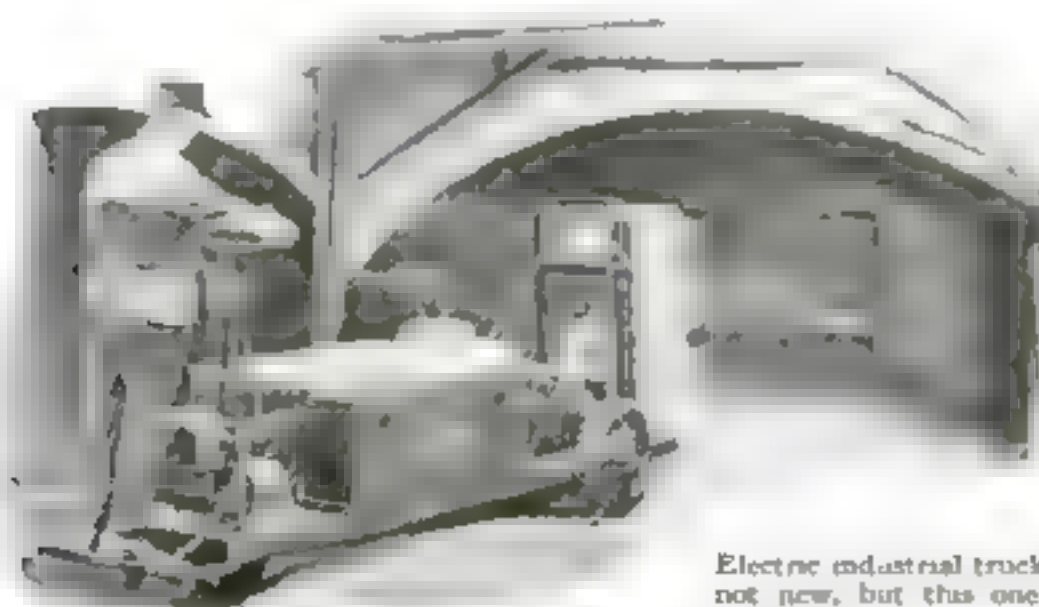
This new safety stop for Fords, invented by a Syracuse engineer, does not depend entirely upon the skill of the driver

Make Driving Easier by This Safety Stop

A SYRACUSE engineer, George G. Porter, has devised a safety stop for Fords that makes it possible to thrust both pedals forward as far as they will go when a sudden stop is to be made. This action is secured by fitting a lever to the clutch pedal. When the pedal is pushed downward out of high gear, the forward part of the lever comes into contact with a stop. Concurrent application on the brake pedal stops the car.

The safety stop is also of assistance in starting or reversing. When the car is not in motion, the clutch pedal is held in the neutral position by a cam actuated by the emergency brake lever.

Without such a stop, the operation of starting the car is to push the clutch pedal forward sufficiently to take up all the slack in the parts, but not enough to throw in the low gear and hold it in this position while the emergency brake is released. With the safety stop this action does not depend upon the driver. He simply pushes the pedal down until the stop comes into play. Then, while the emergency brake is released, he releases the pedal slightly and rocks the foot forward and upward so that the toe engages with the latch and moves it forward to raise the end of the stop lever. This allows the clutch pedal to be pushed forward into low gear.



Electric industrial trucks are not new, but this one is a great improvement over the earlier ones

Some New Ideas for the Automobile Owner and Driver



Spare tires should be placed in convenient places, as shown here, so that they can be easily reached.



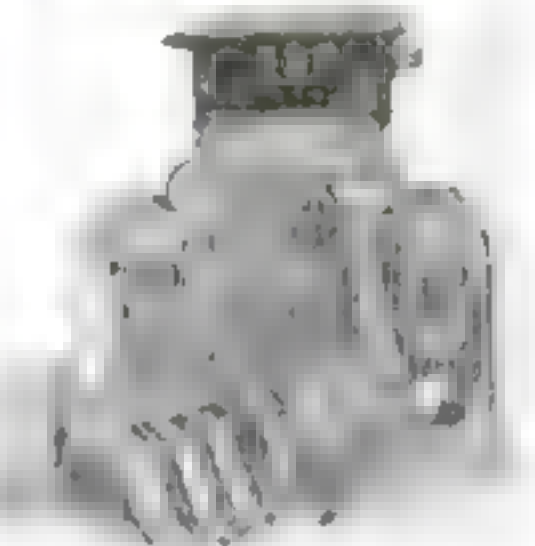
A spare tire mounted on the side of the car is easily accessible.



Spare tires should be placed in convenient places, as shown here, so that they can be easily reached.



Spare tires should be placed in convenient places, as shown here, so that they can be easily reached.



Spare tires should be placed in convenient places, as shown here, so that they can be easily reached.



When an automobile is parked, the spare tire should be placed in a convenient place, as shown here, so that it can be easily reached.



To prevent curtains sagging and flapping and being worn out by the curtain rods, the rod thimble here shown has been invented. It can be attached without tools.



Glaring sunlight may be kept out of the eyes of the driver by a curtain in front of the windshield. It is raised or lowered by a lever connected with the frame.



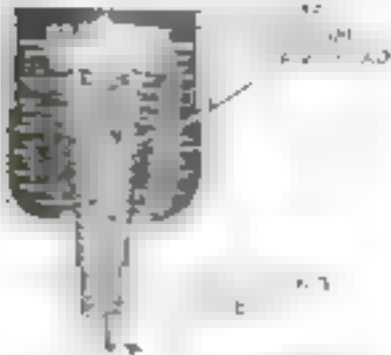
The thermostat here shown is a new type of thermostat, and it is very simple and easy to use.

Do You Want Advice About Your Car?

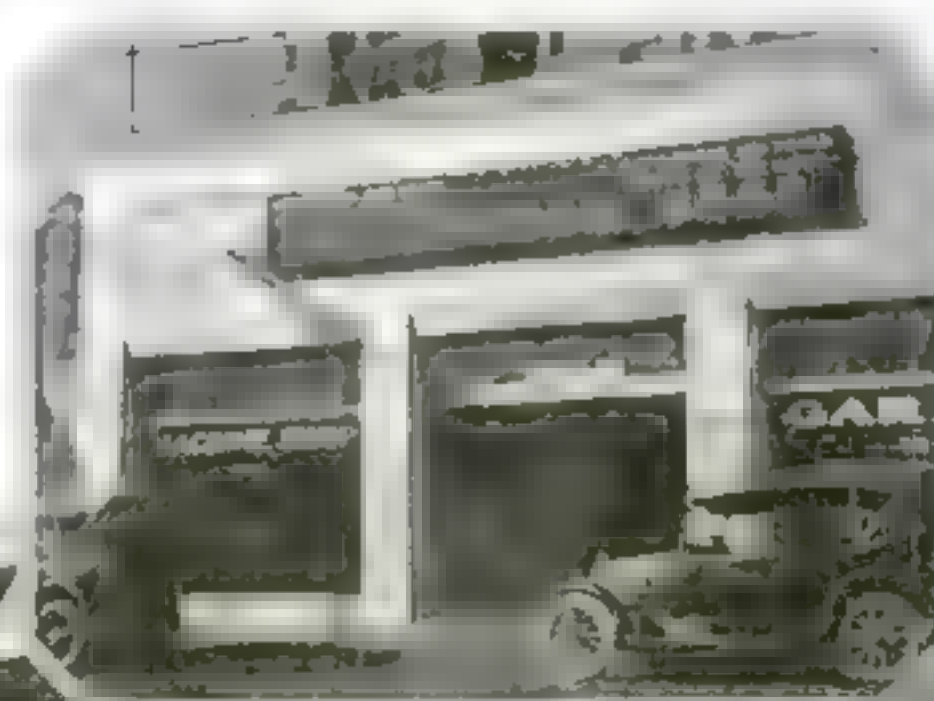
DOUBTLESS you have received many a hint about the care of your automobile or motor-truck from the Popular Science Monthly. We realize, however, that special cases require special advice. We therefore invite you to send your problems to the Auto-

mobile Editor, who will be glad to answer you.

If you wish to know more about the devices pictured on these pages, or if you would like special automobile advice of any sort, ask questions. You will find some inquiries answered on page 80.



When the automobile is still this cone shuts off the oil



Los Angeles houses of the garage shown above. You may own your own garage and repair it yourself, or you may hire a mechanic to do the work, paying as much for space, tool rent, or labor time as the case may be



A radiator of hexagonal mesh is especially durable two times of the strength



With the small electrical tester illustrated here, wiring circuits of automobiles, motor boats, telephone lines, etc. can be effectively tested. A lamp, a buzzer, or a telephone microphone will betray any defect or short-circuiting



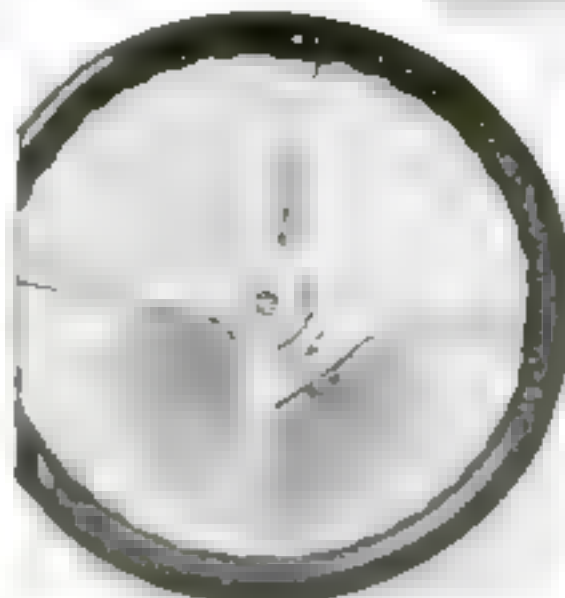
Only when the automobile is in motion will this simple oil cup feed oil to the bearings. The oil is splashed against the top of the cover, flows down to the tip of the inverted cone, and drips through the feed-pipe to the bearings



The centering device for lifting-jacks which is here shown consists of two plat forms movable in grooves at right angles to each other. Heavy loads may be moved short distances with the aid of this device



Small mirrors mounted on ball-and-socket joints are used advantageously to illumine the dials of the various indicators on the instrument-board of the automobile at night. They reflect the light of the cowl lamp on the dials



There is safety in this type of speedometer, which is mounted on the steering wheel and has graduations and figures painted with a radium compound so that it may clearly be read on the darkest night

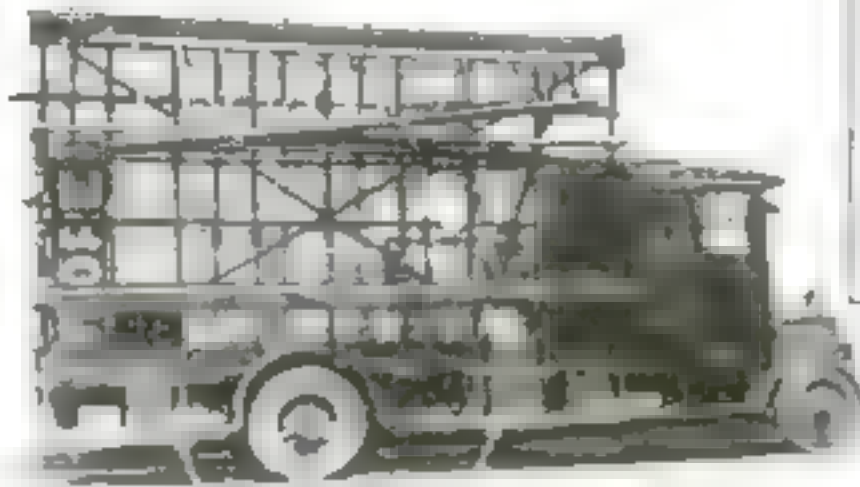


By connecting a condenser with the radiator the loss of water by evaporation will be greatly reduced, as the steam is changed to water in the condenser and, having been cooled, is drawn back into the radiator, keeping up a continuous circulation



In this new truck body the glass is carried vertically, slotted guides and other safety arrangements are provided as indicated.

Here Is a Truck that Was Built Especially to Carry Plate-Glass



A Chicago firm has successfully solved the problem of carrying plate-glass with this truck specially designed for this kind of transportation.



The body is built so that the floor is only thirty-two inches above the ground.

OF all kinds of fragile commodities handled on motor-trucks, that commodity which is probably most subject to breakage is plate-glass in large sheets for windows. Plate-glass combines great bulk and awkward shape with extreme fragility. It is because of these conditions that the adaptation of the motor-truck to this class of work has for so long remained a problem to body-builders.

The main difficulty in the construction of a satisfactory body for handling glass has been to get the floor of the body low enough to remove the glass without lifting and without placing

the truck frame beneath the rear axle. The underslung frame has many disadvantages and has never proved entirely satisfactory.

The problem has at last been solved by a Chicago plate-glass company by mounting the body directly on the frame of the truck so that the body floor is only thirty-two and a fraction inches above the ground when the truck is loaded. The distance between the body floor and the ground is just the normal height of a man's hand, so

that the plates may be loaded and unloaded without lifting.

The sheets of glass are carried vertically instead of horizontally, and not one of the sheets carried during the first year's operation of the truck was broken. Carrying the plates vertically makes it possible to get the largest size into the body, although the latter is easy to maneuver because it is of ordinary width. The plates of glass are kept from shifting while in the body by slotted guides with felt-covered ends that press directly against the glass, as indicated in one of the accompanying illustrations.

Measuring the Farm Tractor's Work

UNTIL the development of the work-measuring instrument that is shown herewith, the farmer had no means of telling whether his tractor was performing all of the work that could be expected of it. If he decided that a three-plow tractor was most suitable for his requirements, he had to take the manufacturer's word for it that the tractor purchased could pull three plows without putting undue strains upon the tractor. He had no ready means of determining whether the tractor could pull four instead of three plows under his particular soil conditions and thus do one quarter more work, or whether he should use only two plows.

With the new instrument he need not rely on guesswork. The instrument consists of a coil-spring connection between the tractor and the implement that it is pulling, be it plow, harrow, or other tool. The pull required to haul the implement is recorded on a dial that forms a part of the instrument, and each dial is graduated by previous tests according to the maximum pull that should be delivered by each individual tractor.

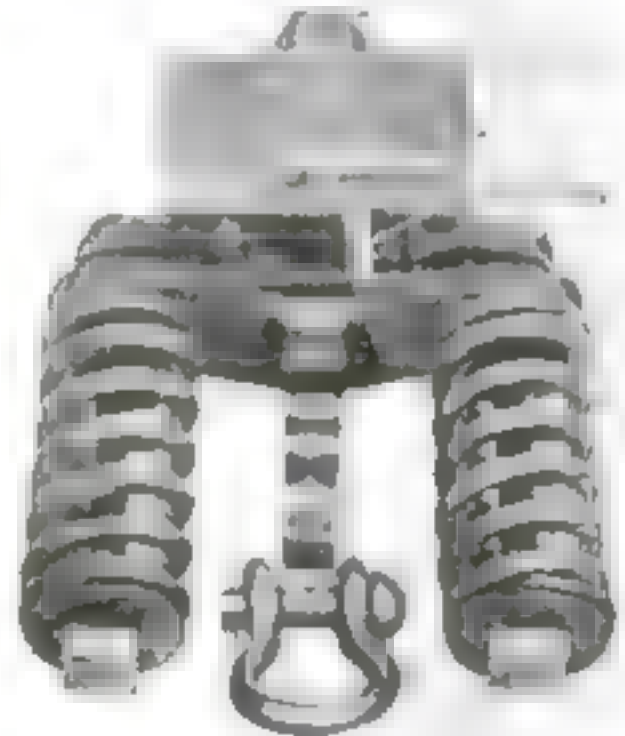
The reading on the dial may be seen

by the tractor driver while sitting in his seat, so that he may tell at once whether or not the tractor is overloaded.

The dial is further connected with a release that automatically breaks the spring connection between the tractor and the tool it is pulling when the pull exerted reaches a predetermined excessive amount. For some makes of tractors, one of the instruments may be set to release for two, three, and



How the instrument is placed on the tractor it records the pull on a dial.



This measuring instrument tells the driver how hard his tractor is working.

four bottom plows at 4000, 5000, and 6000 pounds drawbar pull, which is the average maximum pounds pull that should be exerted by the tractor before releasing.

The instrument has an added advantage in that the use of coil springs provides a cushion to take up starting strains otherwise transmitted to the tractor.

It's Not the Cost of the Truck, But— The cost of keeping the truck running

By Joseph Brinker



Men who operate a fleet of trucks usually employ a mechanic to look after them, but the owner of one, two, or three trucks is dependent on his drivers to watch out for signs of wear.

THE driver holds the individually owned truck in the hollow of his hand. Because the driver is the one person who is actually with or on the truck, success or failure lies with him.

Take any owner who operates two or three trucks. He may be a retail grocer in a large city or a small country town; a florist; a laundryman; a department-store owner; or even a small manufacturer. No matter what his business, if he operates one, two, or three trucks, his problems of truck maintenance are the same. And these are his most important problems; because the cost of operating and maintaining any truck, from one to five tons in capacity, is yearly equal to or greater than the initial cost of the truck, its body, and equipment. In other words, it is not so much the first cost that counts, as it is the cost of keeping the truck running. Any one who owns a passenger automobile knows from experience that this is the truth.

The same holds good with the motor-truck, but to a greater extent, because, while a passenger-car is in use only a small part of the year, a truck is working every day and covers a far greater mileage.

Pay Only for Actual Repairs

The owner who operates one, two, or three trucks cannot afford to hire an extra man to look after the trucks or build a garage or machine-shop where vehicles can be given the mechanical attention they need. The fixed charges represented by the cost of a man to look after the trucks and a mechanic to repair them would be too great when spread over from one to three trucks, even though it might be good business

if there were ten or fifteen or more trucks in the fleet.

Because of this, the owner is forced to keep his trucks in a public garage, or in a building on his own property if such is available, and to depend for repair work upon the local truck-dealer or manufacturer's branch from which the trucks were originally purchased. This is the cheapest method in the long run, because the owner pays only for the actual repair work done, which includes the actual cost of the work and new parts installed *plus* the profit of the dealer or branch agent. This would be less than the salary of a mechanic employed all the year round, because the maintenance work on two or three trucks could not possibly keep such a mechanic busy for the year.

Some truck-owners have been able otherwise to solve the problem by utilizing intermittently the services of a mechanic in their own manufacturing plants or shops, or of a private mechanic who has time to spare. Other owners have taken advantage of the truck-maker's offer to send an inspector once a month or more to go over the trucks and make a report on their condition. Still other owners have been able to secure a driver who was enough of a mechanic to adjust and repair the trucks when his own truck was not engaged. But such repairmen are few and far between. It is the consensus of opinion, derived from the experiences of a great number of users, that the driver should drive and the mechanic should repair. In many cases this decision has been reached only after bitter experiences in which drivers who claimed to be mechanics have tinkered and botched the work so that more money was spent

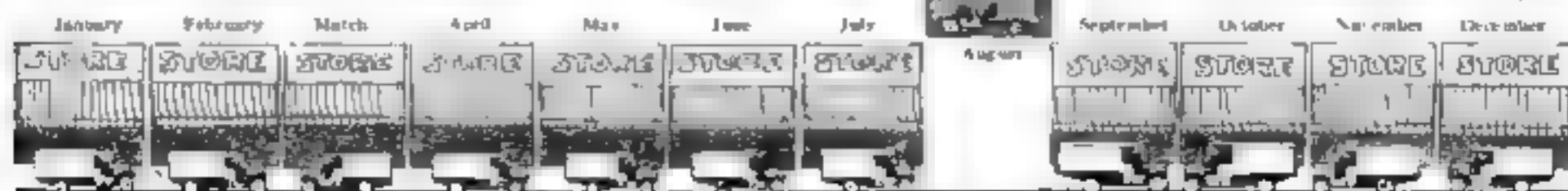
than if a real mechanic had been employed in the first place.

But, no matter in what manner the maintenance is provided for, the solution of the problem always reverts to the driver and the degree of care he gives his truck day after day. No matter what the business of the owner, be he grocer, florist, or manufacturer, his main interest is in selling groceries, flowers, or his manufactured product. With him trucks are but a means to an end, although they play an important part in helping to show a business profit at the end of the year.

No One to Check Up the Driver

As soon as the driver leaves the store or plant, he is out of the sight of the owner. The driver is then in complete charge of an expensive piece of machinery. Whether the driver over-speeds at times and loafs at others, jams on the brakes suddenly, lets in the clutch too quickly, does not change speeds properly, or concentrates the load at one point, the owner cannot tell until the repair bills come in, unless he employs some form of daily driver's report, which will indirectly indicate trouble before it actually occurs.

So, in truck repair, the most difficult work is not the actual maintenance but the inspection or report that indicates what parts should receive the mechanic's care. With a large fleet the owner can afford to hire an inspector to collect this information for him, but with only two or three trucks he must find some cheaper method of obtaining the same data. It is the ounce of prevention instead of the pound of cure that cuts the cost of truck maintenance. A stitch in time, which eliminates a squeak



By constant watchfulness, the wise motor-truck owner keeps his truck or trucks moving eleven months of the year, and uses August, the slack month in business, for repairs.

before it has become a rattle, is what keeps money otherwise spent for maintenance in the owner's pocket.

Just how important it is to eliminate the small ailments before they can grow into big troubles can be shown by one instance. Imagine a truck costing two thousand dollars, and which, through indifferent care on the part of the driver, has worn out in three years. In depreciation it cost \$666 a year. If, by good care, the same truck were made to last five years instead of three, the annual depreciation would be only four hundred dollars a year, or a net yearly saving of \$266—enough to pay the driver's wages, at thirty dollars a week, for almost two months!

This is worth saving, but how?

Daily Report Card

Here again the owner must depend on the driver; for, while he may know little or nothing about the construction of his truck, he is in a better position than any one else to report on its behavior. Experience has shown that the best method to get this information from the driver is by the use of

a driver's daily report-card. For the owner operating two or three trucks the report-card must not be made too simple. If it is too simple, the driver may omit reporting some small ailment that would be caught by the inspector in charge of a large fleet. The driver, in the case of the small fleet, must become his own inspector.

But, because he is not a trained mechanic, the type of questions that he must answer on his report-card should be made simple and general, rather than specific and technical. Suppose, for example, the owner asked the driver to answer questions on the card such as: "Are the valves seating properly?" or "Do the magnets or distributor breaker points need adjustment?"

In nine cases out of ten, the driver could not intelligently answer such questions because of his lack of mechanical and technical knowledge. But if he were asked: "Does your engine lack power?" he could immediately answer "Yes" or "No." At first glance this question might seem entirely too elementary and the answer of no value. But if the driver reported that his engine lacked power,

to the more intelligent owner it would at once set up a train of thought as to the reasons for loss of power, which might include leaking valves, improperly adjusted breaker points, broken spark-plugs, too lean fuel mixture, inadequate lubrication, and other causes.

Questions that Save Money

Such questions as: "Does your clutch engage smoothly?" "Are your brakes working properly?" and "Does your truck squeak and rattle?" can be easily answered by the driver and yet definitely reveal the condition of the truck. Clutches that grab and brakes that are worn need immediate attention, and squeaks and rattles indicate a lack of lubrication just as surely as if a sign inscribed "We need oil" were hung from every bearing.

It is such questions as these, and others asking the mileage run, the gasoline and oil used, and "Are the grease-cups full?" employed with a maker's chart showing when each bearing or part is to be oiled or greased, which are the "stitches in time" that prevent excessive motor-truck maintenance costs.

Write to Us About Your Motor Troubles

If you have a motor-truck or automobile problem, let the Automobile Editor solve it

Soda to Clean the Radiator

Q.—Please tell me how I should use soda to clean the circulating system of my engine. K. M. Paterson, N. J.

A.—Mix ¼ lb soda and 5 gals. water. Strain the solution and then pour into the cooling system, which has been previously allowed to drain out. Run the engine for a few minutes and drain out the solution. Next, pour in some clean water, run the engine again, and drain it out. After this draining, add more water and run the engine as usual.

Kerosene Will Remove Carbon

Q.—Will kerosene remove deposits of carbon on cylinders if admitted in the air intake or carburetor while the engine is running?—G. M. D., Akron, Ohio.

A.—Kerosene introduced into the intake manifold will tend to loosen the carbon in the cylinders if the carbon has not become too hard. Too much kerosene should not be introduced at a time or too often, as it is liable to cut the lubricating oil.

A Tire Gage for Compression

Q.—In several of your back issues I have noticed drawings showing the use of a tire gage inserted in the engine petcock to indicate the compression pressure. Will you please tell me if the use of a tire gage in this manner will give a correct compression pressure?—M. M. New York City.

A.—The use of a tire gage in the manner you mention will give the correct compression pressure if the tire gage is correct and the engine is turning over at a good rate of speed when the gage is used.

Proper Clearance for Pistons

Q.—What is the proper clearance of cast-iron pistons in automobile engine cylinders?—H. V. Detroit.

A.—Piston clearances vary in gray cast-iron pistons from 0.003 inches for each inch of the cylinder bore at the head of the piston to 0.002 inches between the first and second rings, and to 0.001 inches on the lower portion of the piston.

Two- vs. Four-Cycle Engines

Q.—Please explain why the two-cycle motor, used almost exclusively in the first automobiles, has been superseded by the four-cycle type. J. B., Chicago, Ill.

A.—The four-cycle gasoline engine has superseded the two-cycle engine for automobile use because, through the greater development of the former, it consumes less fuel for the same power, is more flexible, and is subject to less trouble with cooling, lubrication, and carburetion.

Fluxes for Soldering

Q.—Will you kindly tell me what are the best fluxes to use for soldering copper to brass parts and brass to iron parts. A. C. B. Kalamazoo Mich.

A.—The most experienced workmen prefer borax and sal ammoniac, the former being employed when the job is a difficult one, such as soldering a small part to a large container, which tends to extract much of the heat of the soldering-iron. Either borax or sal ammoniac removes all the foreign substances from

the soldering-iron and makes it possible to cover it thoroughly with a coating of lead.

Detecting Acids in Oil

Q.—Will you please advise me whether there is any simple method of telling if there are any acids or alkalis present in lubricants such as used on trucks and automobiles. D. S. H., Philadelphia, Pa.

A.—Litmus paper is the most simple test for the presence of acids or alkalis. Commercial litmus paper may be purchased at almost any drug-store. Blue litmus paper when immersed in the lubricant will turn red if any acid is present. Similarly, red litmus paper will turn blue if any free alkali is present.

Why the "8" Runs Smoothly

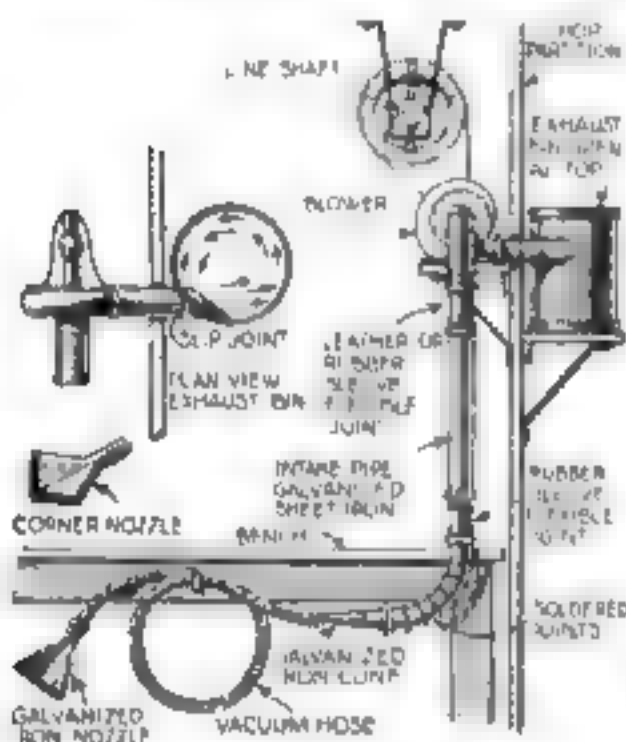
Q.—Please explain in simple terms why an eight cylinder engine is smoother running than a four-cylinder engine. S. C. Brooklyn, N. Y.

A.—The eight-cylinder engine is smoother running than the four because it gives four explosions per revolution of the crankshaft as compared with but two explosions per revolution of the crankshaft in the four-cylinder design. The power impulses transmitted to the crankshaft are more frequent in the eight-cylinder engine and this tends to reduce the necessary weight of the flywheel, the purpose of which is to keep the engine running smoothly from one power stroke or explosion to the next.

The Vacuum Cleaner in the Small Garage

THE owner of a small shop or garage knows the amount of trouble caused by dust and dirt, especially if he does any amount of wood-working. If shavings, chips, and other refuse are allowed to collect, it is easy to lose tools and other small articles, good work cannot be done, and there is danger of fire. If the shop is equipped with a small motor of $\frac{1}{4}$ horsepower or more, a stationary vacuum cleaner can be installed without much trouble; if no motor is at hand and the premises are wired for electric lights, a combined blower and motor could be obtained.

Assuming that a motor is already installed in the shop, the first thing necessary will be to obtain a small fan blower. Second-hand blowers may often be bought cheaply, or, if the shop-owner wishes to build one himself, a blower case could be made of galvanized sheet iron, soldered and riveted together. The impeller and bearings could be bolted to a separate substantial base. Provision must be made for driving the blower at the required speed,



This arrangement of a suction cleaner will be found practical in most garages

which for a small one is in the neighborhood of 4000 r.p.m. As large a blower as possible as determined by the power at hand, should be installed. A 1.16-horsepower motor will drive one having an impeller from 6 to 8 in. in diameter.

The blower is placed so that the exhaust can be carried out through the side of the shop into the open air, but in such a position that the piping, both intake and exhaust, can be as short and have as few bends as possible. Light tin or galvanized sheet-iron piping is used, though there is no special objection to using regular iron pipe for the exhaust line. All joints in the intake pipe must be tight and this is best insured by running solder around them and testing under air pressure, if this is possible. To allow a certain amount of flexibility to the inlet pipe and yet keep it airtight, one or more rubber or leather joints may be installed so as to allow a greater "reach" to the cleaner hose and nozzle. A length of inner tube about 8 in. long is suitable, or sheet rubber or leather with cemented joint can be used. The sleeve is bound to

the pipe with a wrapping of copper or soft iron wire.

At the lower end of the intake pipe a long cone, made up of sheet galvanized iron or tin, is soldered. A sleeve soldered to the small end of the cone takes the cleaner hose, which is one of the regular pieces of equipment of the electric vacuum cleaner and may be bought separately in about a 9-ft. length.

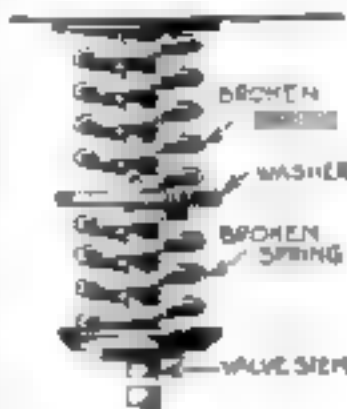
The nozzles used can be bought also, but can be easily made from galvanized iron. The illustration shows one with a square end for reaching into corners.

How I Made a Temporary Valve-Spring Repair

HAVING broken an exhaust valve-spring on my motorcycle when I was miles from a repair-shop, I hit upon the following simple and effective way of repairing the damage.

Taking from the toolbox an iron washer having an outside diameter slightly larger than the coiled spring, I placed the washer between the two sections of the spring, letting the valve-stem pass through the hole in the washer.

This apparently operated as well as a new spring; in fact I rode the motorcycle several hundred miles before replacing the broken spring with a new one.—H. E. PAGE.



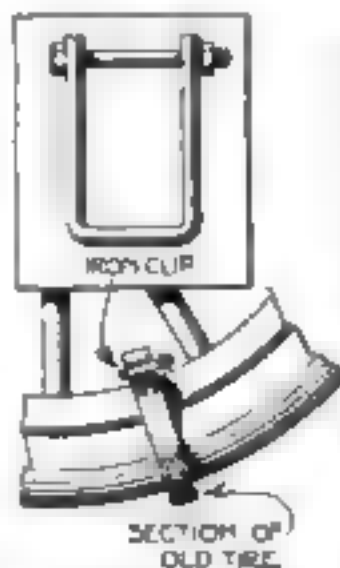
How a broken valve-spring was repaired

Old Tires Used for an Anti-Skid Device

OF the various ways to utilize worn-out pneumatic tires, one of the most satisfactory and practical is to cut them up and use them instead of chains as anti-skidding devices.

To utilize the tire as a chain, first make about eight or ten clips—four or five for each wheel—as shown in the illustration. These consist of pieces of band iron about $\frac{1}{2}$ in. by 4 in. long, with a $\frac{5}{16}$ -in. hole drilled in each end and bent as shown with about a 1-in. opening. Then a $\frac{5}{16}$ -in. machine-bolt is inserted in the ends and the clip is complete. These strips grip the ground and prevent skidding.

Then the good part of the tread is cut into strips about $1\frac{1}{2}$ in. wide and long enough to go around both the tire and felloe and project about 2 in. The clips described above are used to fasten the ends of the strips as well as to hold them in place.—S. O. NAFZIGER.



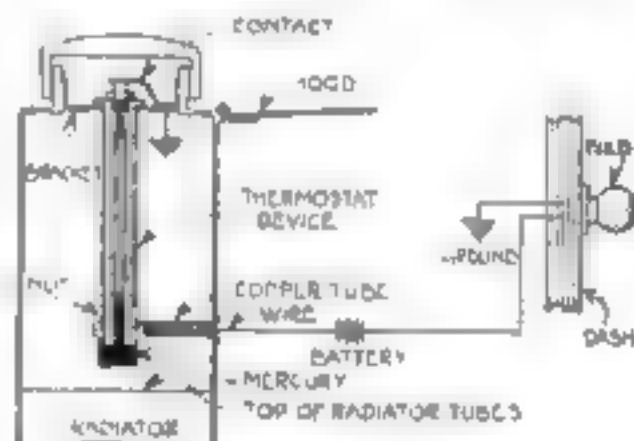
These strips grip the ground and prevent skidding

A Warning Light Means a Hot Engine

BELOW is an illustration that shows a homemade and very effective hot-motor alarm. Any car owner with a little mechanical ability can easily build one. The sketch shows a section of the radiator at the top of the water chamber. The main tube of the thermostat device is made of bakelite or one of the impregnated bakelite fibers that is water and steam proof. The top of this tube is threaded into a bracket which is in turn soldered into the neck of the radiator. The lower end of the tube is also threaded into the mercury chamber which is made of fiber. This chamber is locked and made leak-proof with a nut. At the upper end of the tube is the contact which is provided with an extension contact of brass and which is also led out through a brass ribbon and soldered to the supporting bracket, thus making a ground connection on the car.

After the device is assembled the copper tube is soldered in place and a wire led out through it to a small lamp on the dash. The circuit is made through the battery circuit on the car as shown. The mercury chamber is threaded on to the thermostat-tube so that the device can be adjusted.

This is accomplished by submerging it in boiling water and then setting it just a trifle short of making the circuit. In other words, when the water in the radiator reaches the boiling temperature, the motor



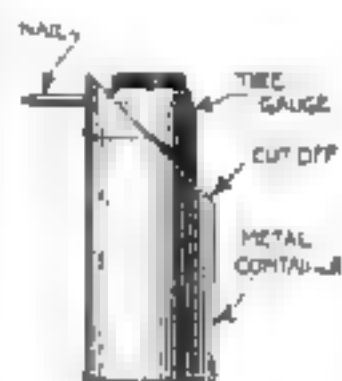
When the engine becomes overheated, the driver is warned by the flash of the dashboard lamp

is dangerously overheated and needs attention. At that point the mercury is so expanded that it rises in the tube and completes the circuit, thus lighting the lamp.

Find a Special Place for the Tire-Gage

A PLACE for everything includes a place for the tire-gage, and instead of searching around the toolbox under the rear seat of the automobile for the tire-gage,

take a small container such as a shaving-soap box, cut a section out of one side and with a nail fasten the box inside the tool compartment. The tire-gage, when placed there, can be located instantly when air is to be put in the tires.



Keep the tire-gage where you can find it

Carry Chicken Wire on Your Motor Trips

IN certain parts of the United States you will find some pretty bad roads. Some of them are almost impassable for motor-cars in wet weather. A party of motorists encountered a section in a Western state where the soil was sandy and their heavy touring-car had considerable difficulty negotiating the roads, particularly as the ground was still wet after a heavy rain-storm. In many instances the sandy soil was so soft as to come up over the tires



Wire fencing, such as used around chicken yards, will enable an automobile safely to cross muddy spots on soft country roads.

almost to the hubs, often preventing sufficient traction to enable them to keep going.

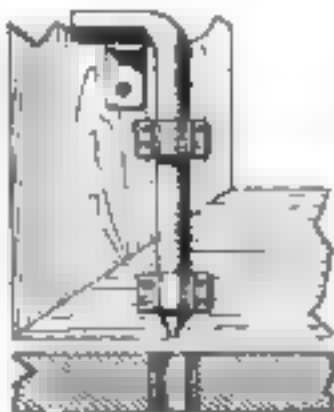
But the driver was of the inventive type and he hit upon an idea that may be of value to you when you encounter almost impassable roads. He obtained a roll of chicken wire wide enough to cover the tread of the car. Whenever a bad spot was reached, one of the car occupants proceeded to unstrap the roll from the rear of the car and stretch it over the bad piece of road. They would run over the wire and laugh at the deep mud lying in wait for those less ingenious. The wire prevented the wheels from sinking, acting on the same principle as snowshoes do when traveling over drifts.—F. G. JUMP

A Fastening for the Garage Door

WHEN building a new garage, many car-owners are at a loss to know how to fasten the bottom of the large swinging-doors with which garages are usually equipped. The fastening shown in the illustration has proved satisfactory and convenient.

In pouring the cement floor, a short length of pipe was placed near the doorway and slightly to one side of the center. The pipe was placed in a vertical position, its upper end being set flush with the top of the garage floor.

The bar was made of a piece of round stock, the diameter making a sliding fit inside the pipe. One end of the bar was tapered and the other bent at right angles



This is a good fastener for the swinging garage door.

to form a handle. It was secured to the inside of one of the doors by means of two mild steel loops in which it could either turn or slide. When the door was being opened or closed, the bar was kept from dragging by a block at its upper end on which the handle rested.

To lock the door the handle was turned at right angles, so that it cleared the block and dropped into the pipe. The other door was then closed and locked to the first from the outside. A piece of pipe may be driven into the ground at such a place that the door can be held in the open position by the same bar.—L. R. BUTCHER

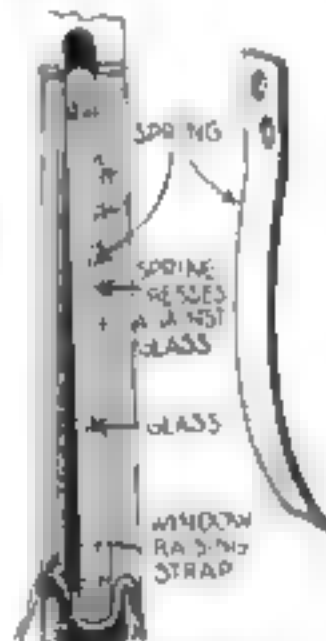
That Annoying Window Rattle Can Be Stopped

FREQUENTLY the windows of a sedan or coupé will rattle, to the annoyance of the driver and other occupants.

Loosening the guides or frames and moving them closer to the window will take out the rattle for a short time, but the results are only temporary and the windows are so difficult to open that a second person is necessary to go outside the car and push them in so they may be lowered.

In the illustration a simple attachment is shown that will silence the window and also assist in opening it without assistance. It consists of a flat steel spring such as a piece of spring from an old alarm-clock or a corset steel.

Put two holes through one end and screw this to the outside guide or frame so that the tension of the spring will push the window toward the inside of the car. This will hold the glass securely, and when it is desired to lower the window, the spring, pushing in, will press the glass free of the ledge while it is being lowered with the strap.—G. A. LUKAS



The pressure of the spring prevents a window rattling.

Keep Your Brakes in Good Condition

STOPPING to consider that your entire safety, especially in heavy traffic, depends upon the reliability of your car's brakes, there is food for thought. Safety demands that the brakes be kept in the pink of condition.

First, they should bind tightly and surely when pressure is applied, and be free and ride clear when the pedal or lever is released. A brake shoe that binds when released, produces constant friction and makes hard running, besides wearing out the brake-lining.

Slipping of the brakes is primarily caused by poor adjustment, oil between the surfaces, or worn linings.

Poor adjustment can be remedied easily. Oily surfaces can be cleaned by taking out the shoe and cleaning with gasoline. Then the source of the oil leakage should be traced back and stopped. Oil generally

comes from the rear axle. A new washer will usually rectify this trouble.

If the bands are too worn to allow any readjustment, they will have to be re-lined. Fabric linings are to be preferred to those of leather, as the latter are apt to quickly burn out from the heat generated by constant application of the brakes.

Sometimes, when the brakes are applied, the car has a tendency to skid to one side. This is an indication that one wheel is being braked while the other still runs free. The brake-rods should be inspected and the difference in adjustment equalized.

Squeaky brakes usually indicate dirty linings. These should be cleaned with gasoline—then roughened with a wire brush. The dirt must be entirely removed from the pores of the fabric and a new surface presented to the brake-drum.

Little lubrication of a brake-lining is necessary—yet a few drops of thin oil once every few thousand miles will clear away any dirt and maintain a soft surface toward the brake-drum. Oil the hangers, ears, etc., connecting the brake-rods with the bands to reduce squeaking, chattering, and undue wear.

In the readjustment of your brakes, it is important to watch for the proper clearance. This can be any where from 1/16 to 1/64 in. all around. If the band clings to the drum at any point after sufficient clearance has been gained everywhere else, then that particular point must be sprung slightly away from the drum by inserting a screwdriver or similar instrument between it and the drum.—L. B. ROBBINS

A Superior Tightener for Wheel-Chains

A CHAIN-TIGHTENER as illustrated can be made in a few minutes from materials bought for a few cents at any repair-shop. Or, better yet, get down the box of odds and ends; possibly you already have all the material necessary.

To make one set (two wheels) you will need:

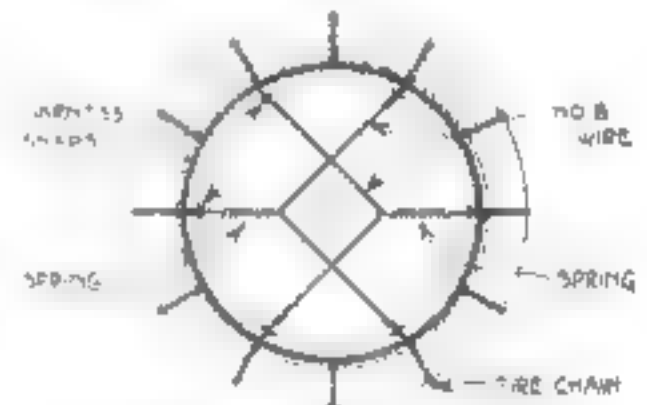
12 to 15 feet of No. 8 wire

4 springs 4 to 5 in. long, 3/4 to 1 in. in diameter

12 small harness snaps

4 harness rings, 1/2 to 1 in. in diameter

Select and snap in six snaps at equidistant points on the outside runner chain. Cut and twist in wires as shown, making them long enough to clear the hub of the



Chains cannot slip and chafe if they are held tight in the manner shown.

wheel. Hook the spring to the wires and tighten them, making them short enough to give a good tension on all three points of contact.

Repeat this for the other half of the wheel and the arrangement will appear as shown in the illustration.

Always place the tongue of the snap toward the inside in order to protect it from stones, etc.—J. D. KING

A Bait Casting-Rod and How to Make It

By Robert Page Lincoln

IN the following instructions on how to make a bait casting rod, a radical departure has been made from the ordinary method of making rods. It is so valuable and economical that any one desiring a rod of his own make can easily go ahead with it and produce good work, having, at the same time, a rod that is equal to the best of them. Incidentally it may be said that the materials that go into the rod cost little and yet give surprising results. One should be able to turn out six or eight rods of this sort for the price one pays for one, of a good sort, in the average sporting-goods store.

The rod is a two-piece one, the butt piece being hickory and the tip bethabara. The tip section of the rod is 40 in. long; the butt piece 26 in. This gives a 6-ft.-6-in. rod, which is the regulation length for a bait-casting tool.

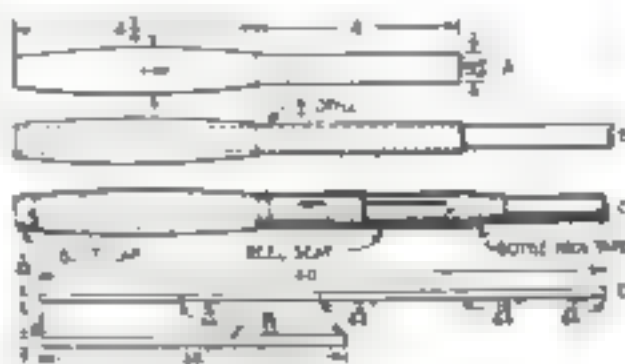
Experiments with various rods to ascertain where best to join the tip piece with the butt piece, have led me to place the jointing ferules below the center of the rod. By having the jointing place in the exact center, the action of the rod is impaired, and the rod, by the same token, is weakened.

By placing the jointing point below the center, the action is thrown on the tip piece and the best results are obtained.

The handle is a solid piece of wood (hickory can be used), as shown in A. A $\frac{1}{2}$ -in. hole is bored through this piece while it is clamped tightly in a vise. The piece is $8\frac{1}{2}$ in. in length; 4 in. of this is cylindrical, slightly under $\frac{3}{4}$ in. through,

so that the $\frac{3}{4}$ -in. reel seat can be pressed over it snugly and tightly when ready.

The handle is $\frac{3}{4}$ in. through at its thickest portion. When this handle is ready, it is wound with heavy green fishing-line of the ordinary trolling type. When covered with this, it should be 1 in. through instead of $\frac{3}{4}$ in. But before wrapping the handle,



Double your pleasure in fishing by using a casting-rod of your own make

fit in the butt piece of the rod. This is of hickory. A piece can be obtained in any lumber-yard.

The illustration (D) shows the two pieces of the rod, the tip and the butt. The end of the butt piece that is fitted into the handle piece is 16 32 in. for 1 ft. of its length, then it tapers to 19 64 of an inch. Sink it in snug and tight and touch it up with glue so that it will stick. You will now have arrived at the point that is shown in B.

The illustration (C) shows the butt end of the rod completed. In wrapping on the

green fishing-line, brush on a good grade of glue and soak the line with glue, too, so there will be no coming off. The butt cap fits snugly over the wound portion and is held firmly in place with two screws, one on each side, and one in the end if desired. The reel seat is then slipped over the 4-in. cylindrical portion and also is pressed home so that it covers the winding. Brush well with glue on the wood under the reel seat. Enough of this protrudes so that the bottle-neck taper fits over it, also to be screwed in place. When selecting the reel seat and the butt cap, remember that both are of the $\frac{1}{4}$ -in. grade, with the bottle-necked taper to match the reel seat.

Since the action of the rod is thrown on the tip piece of the rod, it is well that that piece be of a high-grade material. Enough to say that bethabara is the best material to be had.

A stick of 1 22-in. stock, 46 in. in length, will cost you probably 75 cents, and can be had from any well-supplied sporting-goods firm. See to it that this stick is straight grained and free from worm holes and rot places. The thickness of the rod is indicated in the drawing (D) at every 10-in. point.

You will need a tiptop offset guide and three guides between the reel seat and the tip, one 5 in. below the jointing place in the center; the next one (proceeding toward the tip) 14 in from that one, the third one 9 in from the tip. To join the rod together, a male and a female ferule is needed. These should be of the 21 64-in size. Select the capped and welled form.

Don't Wish for an Icebox—Build One

THE occupant of a small newly built house found himself without a refrigerator, but well supplied with remnants of building and moving, including plenty of sawdust and assorted packing-boxes. Taking advantage of circumstances, he proceeded to build an icebox.

Two stout wooden packing-boxes were selected, of such size that the one would fit inside the other with about 2 in. of space on all sides.

This space was packed with sawdust, and the lid of the outer box was removed, that of the inner box was attached with some cheap hinges. The resulting heat-insulated box was set in the basement, as shown in the photograph. A piece of ice was placed inside the box, and the food to be kept was set down beside it. As the ice melted, the water soaked through the sawdust and ran to the cement floor, which was provided with a drain-pipe near by.

An additional convenience was a series



The open lid discloses the double walls filled in with heat insulating material



At one end of the refrigerator shelves are provided on which to place dishes

of shelves erected at one end of the icebox, on which dishes could be set preparatory to arranging them in the icebox.

This crude refrigerator has been found to be scarcely less economical of ice than a first-quality manufactured article, and has proved generally satisfactory to its owner. CURTIS RALSTON

Safety First in Opening Powder-Kegs

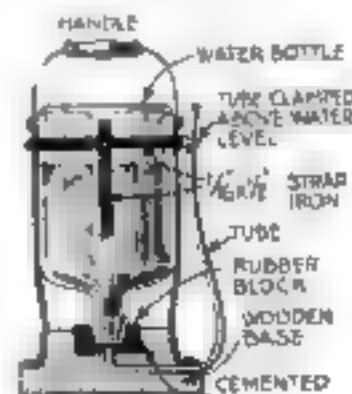
SEVERAL disastrous explosions have occurred—one at Sublet, Wyoming, which caused the death of six miners—from driving a sharp-pointed hard-wood wedge through the top of a steel powder-keg.

Experts assert that there is sufficient heat generated in driving the wedge to ignite black powder; that any method employed to puncture powder-kegs is extremely hazardous and should be avoided. Opening the bung of the keg is the only safe practice.

Every Garage Should Own This Distilled-Water Carrier

TO fill a battery from a large container of distilled water is not always convenient. The practice of pouring distilled water from one container to another before the battery is supplied should be discouraged as it permits of impurities getting in.

The accompanying illustration shows a carrier with a 1-gal. bottle that can be conveniently carried from car to car. The supporting frame is made of 1, 16 in. by $\frac{1}{2}$ in. strap iron and riveted as shown. Four uprights and a circular band make the frame. A handle may be fitted to two of the uprights. The wire handle from an old pail will serve nicely. The stand is made of a wooden block to which the frame is screwed. A recess is turned into the block as shown. A block of rubber is fitted into this recess. This block of rubber is recessed to take the neck of the bottle, and a hole is drilled in the center of the recess large enough for a $\frac{3}{4}$ -in. rubber tube to pass through. The tube must be cemented into the rubber block in order to prevent leakage. The tube must be long enough to reach to the top of the frame. If the tube is clamped to the top of the frame when not in use, a valve will not be required.



Convenient for carrying water for filling batteries

Producing Queer Effects by Double Printing

By Cora Hamilton



This composite picture was made by combining the two other pictures as described below

MANY queer and amusing effects in photography may be produced by masking, silhouetting, and double printing.

The picture of a giant hen apparently taking a ride in an old fashioned automobile was produced in the manner described here, and will suggest other interesting combinations that may be obtained in the same or in a similar manner.

The first picture shown is a combination of the second and third pictures.

For making the prints, any of the commercial printing-out papers may be

used. The third picture shown was first printed very lightly. Then the negative was removed and a negative of the hen was placed in the frame so as to bring the picture of the hen in its place over the automobile seat. After a short exposure both pictures showed on the print, which was then ready to be used for the masks.

The picture of the hen was carefully cut out of the picture with a sharp knife, leaving an opening representing the shape of the fowl. Then both parts of the cut-out were exposed to the sun to blacken them. Neither toning nor fixing was necessary.

The negative of the car was next placed in the frame and the hen silhouette was placed in the proper position between the negative and the sensitized paper so as to block out that part of the picture where the hen was to be. After the print was dark



The picture of the old-fashioned run-about that formed the foundation of the composite print

enough, it was removed from the printing-frame and the negative of the hen was put in the frame. The mask from which the hen picture had been cut out was placed on the negative so that it covered everything but the picture of the hen itself. The masked print was then placed face down on the negative so that the hen fitted exactly into the blank space of the print. Next the frame was exposed to the sun until the hen print was approximately as dark as the rest of the print. After toning and fixing the print, the picture as shown was obtained.



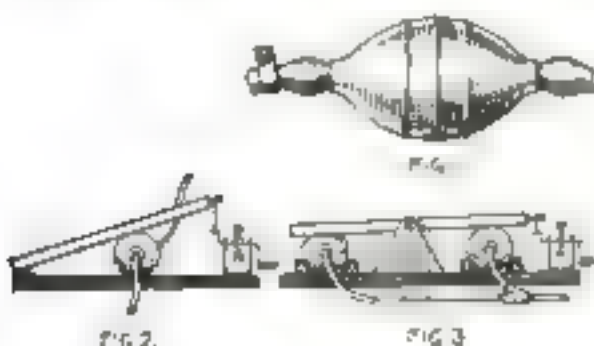
Biddy's portrait was transferred to the point of the combout by silhouetting it

A Simple Force Pump Made from an Atomizer

A FORCE pump that is very useful for all sorts of small and light jobs can be made from the rubber bulb of an old atomizer.

Take the rubber bulb, with the thin rubber tube to which it is attached; push a piece of bath hose over the rear end of the bulb and secure it in position by means of a tin strap and a nut and bolt, as in Fig. 1. You now have a complete force pump, the bath hose acting as intake and the thin tube as delivery.

The pump can be still further im-



One or two atomizer bulbs can be used for making a footpower force pump.

proved by adapting it so that it can be driven by crank or pulley, as shown in Fig. 2.

Figure 8 shows a still further refinement by means of which an almost steady flow of air or water is obtained.

Keeping Razor Edges Free from Rust

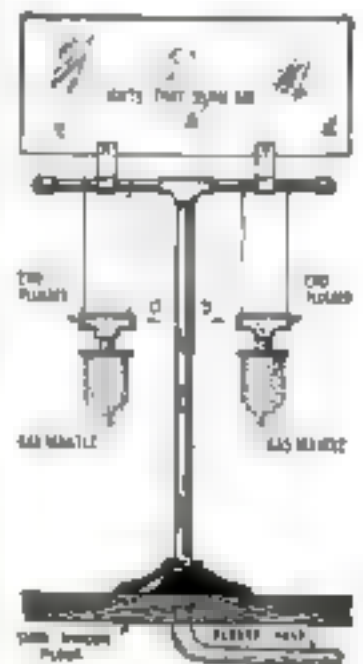
THE writer has found by actual experience that oil positively helps to keep razors sharp, whether they be of the ordinary or the "safety" type. The best to use is a light and absolutely pure oil. An excellent manner of using it is to put it into a medium-sized bottle.

In the small end of the cork make a cut with the small blade of a penknife, into the cut introduce absorbent cotton, previously rolled into a ball, to form a sort of dauber. Apply lightly the edge of the razor-blade to the moistened dauber

Insure an Attractive Show-Window

THIS novel attraction for a show-window can be made out of pipe-fittings at small expense. The pipe is of $\frac{1}{2}$ -in. stock. At points *a* and *b* in the stem a hole is drilled which should be no larger than the shank of a pin

It is from these two holes that the gas escapes to the tees on which are fastened the mantles. To adjust the mixing of the air and gas the tees should be moved back and forth until the mantles burn the brightest. The drawing is self-explanatory.



The gas is blown through small holes into the tubes above the lamps.



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Taylor Home Bake Oven Thermometer



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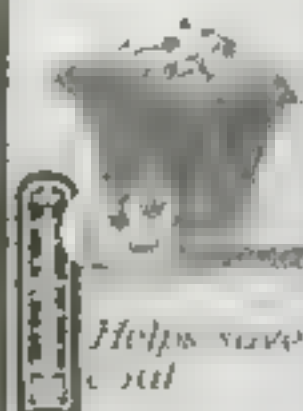
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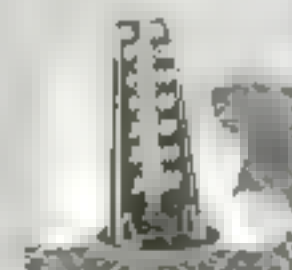
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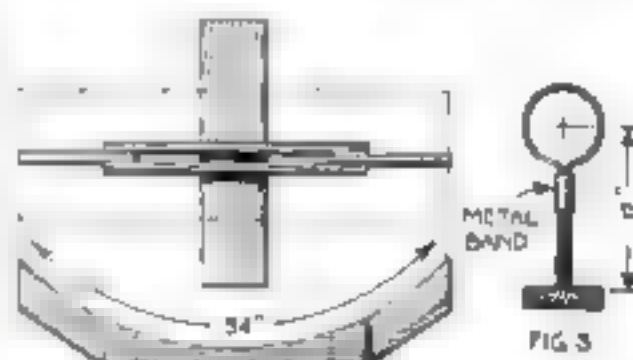
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Utilize the Sun to Blow a Steam Whistle

SOLAR engines have been built by many inventors, but most of these were expensive and complicated, quite beyond reach of the amateur.

The illustration shows a solar whistle, such that any boy can make, provided he knows how to solder. The apparatus is made of a reflector, a boiler, and a whistle.

First the reflector is built, the wooden frame of which is shown in Fig. 1. Its parabolic, not semicircular, curve should be



Page 4

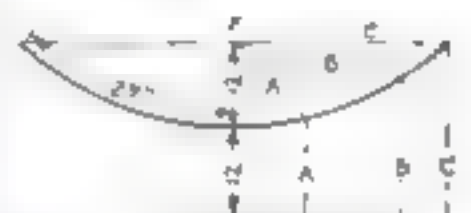


FIG. 2

In Fig. 1 the construction of the parabolic mirror is explained. In Fig. 2 the support of the boiler, and in Fig. 3 how to draw a parabola.

carefully drawn, then cut with a spokeshave, jackknife, or saw. Figure 2 shows a method of drawing a parabola. A and A, B and B, C and C, etc., should be of equal lengths. To this curve a surface of brightly tinned metal is tacked. The sides of three large coffee-cans have been successfully used for this purpose. A length of heavy wire is fastened to one end of the cross frame, Fig. 3, to hold up the holder, the glass casing of which is shown in Fig. 5.

At this point, the heating ability of the reflector should be tested and its focus or focal zone determined. The day must be clear, with a temperature of eighty or above. Smoked glasses had best be worn

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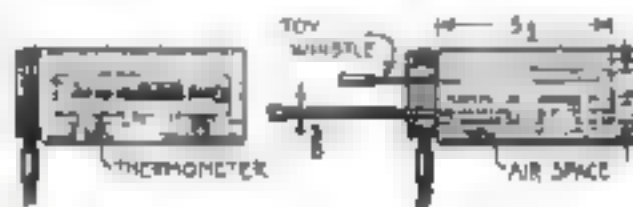


Fig. 4

Fig. 6

Here is shown how the boiler is tested and how it appears when fully equipped with filling-tube and whistle

as the glare of the reflector is blinding. In a protected corner the reflector is set up facing the sun. It should be moved so that the rays converge just over the center, adjustment being made by passing a piece of white paper through the focal zone.

The glass jar is then fixed in the wire frame and a thermometer placed in the jar, Fig. 8. In five or ten minutes it should read at least 230° F. In place of the thermometer a black metal vial filled with water may be placed in the jar. It should boil in two or three minutes.

The cylindrical tank or boiler to be placed in the jar has a filling-tube fitted

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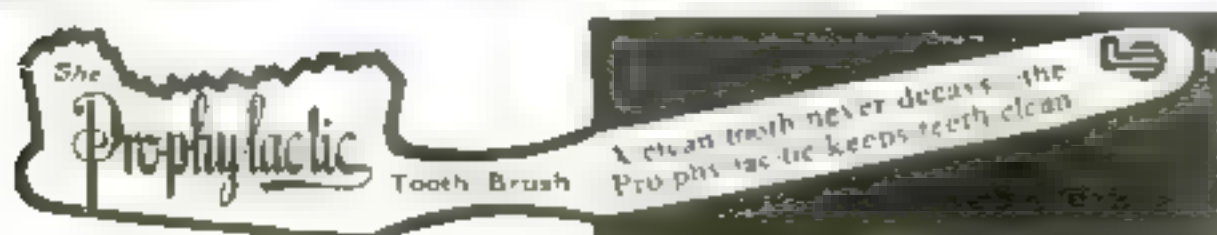
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MACHINE SHOP WORK

[illegible]

360 pp. 401 illus. Price, postpaid, \$2.00
 Popular Science Monthly, 225 W 30th Street, New York

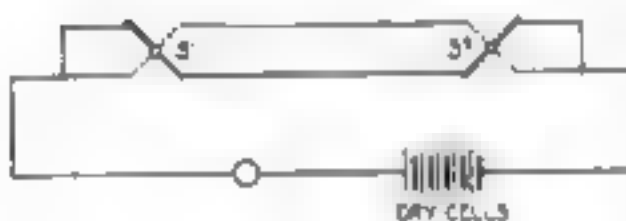
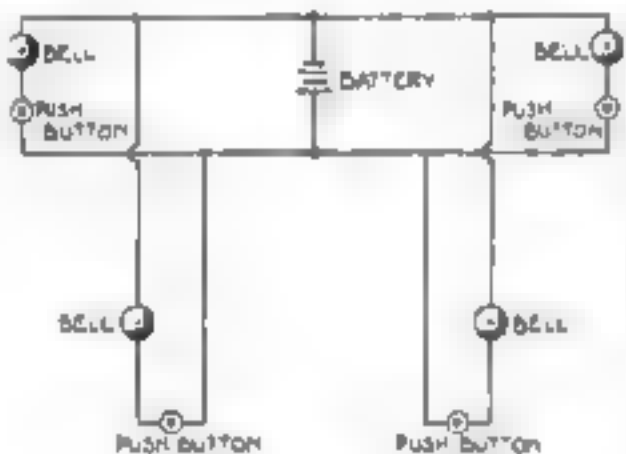


with a screw-cap cut from a discarded oil-can. This tube and the steam-pipe are soldered to the lid of the jar and hold the cylinder in position. With a coating of dead black enamel the boiler is complete. A steam whistle from a dismantled toy engine is soldered to the steam-pipe, Fig. 5.

In general, the glass of the casing should be clear. An olive-jar with a metal screw-cap has served very well. The boiler had better be too small than too large. No attempt should be made to polish the shiny tin surface of the reflector.

Useful Wiring Diagrams for the House

IT is frequently desirable to be able to ring the same bell from a single cell by either of two push-buttons or to ring several bells from the same battery. Simple as these propositions may sound, to many persons they present quite a puzzle. The



These diagrams illustrate the wiring for single or multiple bells. The second diagram shows the double control of a single lamp.

accompanying diagrams show the necessary wiring and are self explanatory.

Another diagram shows how it is possible to turn on a lamp at one end of a corridor and turn it off at the other end. As the diagram stands, the lamp is lighted, but it may be turned off from either end and relighted from either end. It makes no difference in which direction one passes through the corridor, the switches will always work. Passing from S to S, and extinguishing the lamp at the latter point, upon returning it may be relighted by turning switch S, into its original position. Or another person following in the same direction may always relight the lamp. F. L. DARROW

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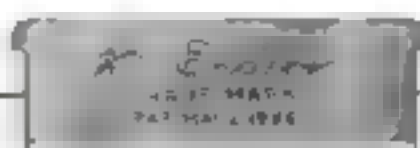
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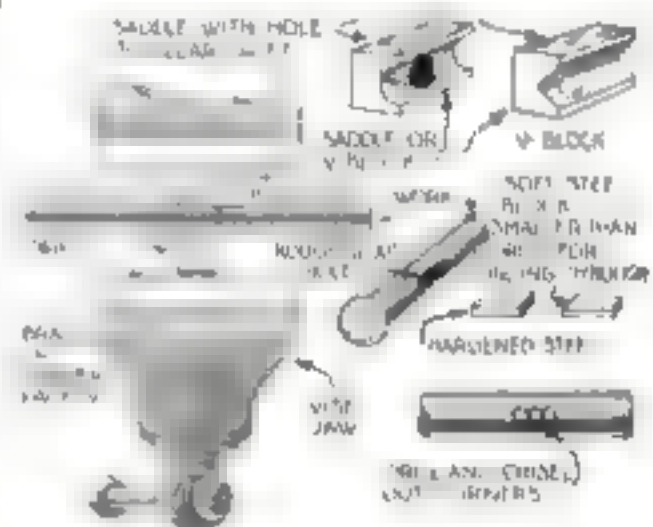
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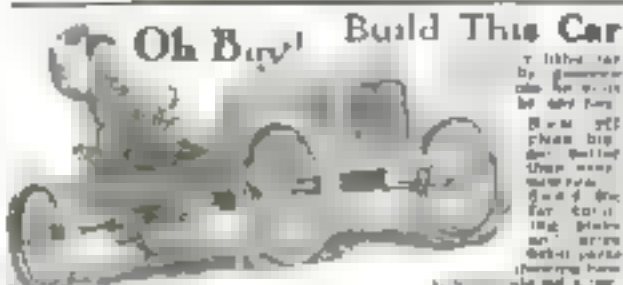


the rear, but never toward the front edges, for this would cause the drift to act as a wedge and bind in the hole.

A heavy machinist's vise will be the most convenient means of forcing the drift through the roughed-out hole, but if too much pressure is required, it indicates that an excess of metal is being cut out by the drift, and to prevent its binding or breaking, the work should be removed and the drift forced out backward and the hole filed out nearer to size.

A packing-sheet of brass or copper is placed between the drift and vise jaw, and in order to allow it to be forced all the way through the work, the latter is supported by a saddle on that side. The saddle is made by drilling or boring out a block of cast iron to fit the work and then sawing it in half and drilling a hole through it to give clearance to the drift. Lacking a saddle of this kind, an ordinary V block may be made to serve the purpose by letting the end of the drift through. Then packing is inserted between work and vise jaw so that the drift may be forced farther out. A soft steel block will also be required back of the drift to force it all the way through the work, unless this was itself made long and the rear portion ground away for clearance.

If the draft is properly constructed, the hole roughed out nearly to size, and sand-oil or other lubricant applied, the resulting hole will be as smooth and accurate as could be desired.—H. B. PARKER.



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How to Save the Cost of Scaffolding Timber

SOME time ago the slate roof of my house needed repairing. When I learned that it would cost me twenty dollars or more for the scaffold that would enable the roofers to do the work in safety, I tried to find a way to avoid this expense. The pictures show how I made this possible by means of a roof jack,



The board, resting in the gutter, prevents the ladder from sliding

which I improvised and attached to the ladder in the manner shown.

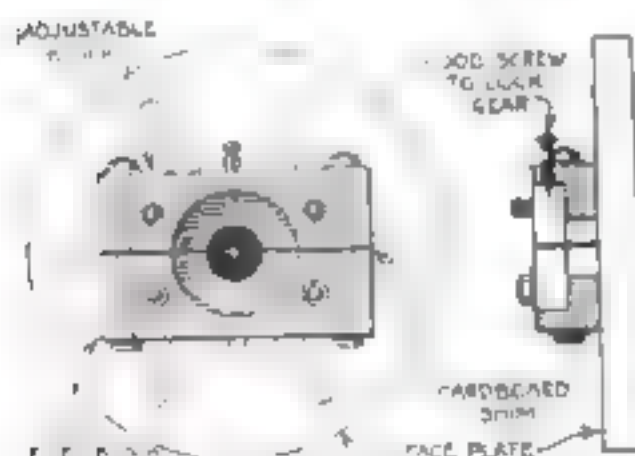
I used a board about 8 ft. long, and bored 2 holes in which I put a heavy wire, fastening the ends of the wire to a rung of the ladder.

When placed in position on the roof, the board would rest in the gutter and prevent the ladder from sliding down the slanting surface. The ladder would safely support the weight of two average men.—D. L. MERRILL.

A Hardwood Chuck for Machining Small Gears

SOME small cast-iron gears were required to be bored out to a larger diameter and faced off and as no suitable equipment was at hand, a hardwood chuck was made up for the purpose that would prove suitable for other small parts besides gears.

Two hardwood blocks were used, one being permanently bolted to the lathe faceplate, with one edge even with the line of



In an emergency this hardwood chuck was used in boring and facing gears

the lathe centers. Then another was bolted to this by means of two long bolts through the edges of both blocks; cardboard shims were put between the blocks before tightening the bolts. Two holes, larger than the bolts to be used, were drilled through the second block and bolts put through it and the faceplate and tightened up.

Next, a hole slightly larger than the desired bore of the gears was drilled through



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One object is to fight the film—that viscous film you feel. This is the teeth's great enemy. It dims the teeth and causes most tooth troubles.

Film clings to teeth, gets between the teeth and stays. The ordinary tooth paste does not effectively combat it. So night and day it may do a damage which few people have escaped.

It is the film-coat that discolours, not the teeth. Film is the basis of tartar. It holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay.

Millions of germs breed in it. They, with tartar, are the chief cause of pyorrhea. Despite the tooth brush, all these troubles have been constantly increasing.

New methods now

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Watch these desired effects

Pepsodent combats the film in two effective ways. Then it leaves the teeth so highly polished that film-coats cannot easily adhere.

It also brings other effects which modern authorities desire. It multiplies the salivary flow, as certain foods would do. That is Nature's great tooth-protecting agent.

It multiplies the starch digestant in the saliva, to digest starch deposits which otherwise cling and may form acid. It multiplies the alkalinity of the saliva, to neutralise the acids which cause tooth decay.

Thus twice a day it brings to users unique tooth protection.

Send the coupon for a 10-Day Tube. Note how clean the teeth feel after using. Mark the absence of the viscous film. See how teeth whiten as the film-coat disappears. Read in our book the scientific reason for each new effect.

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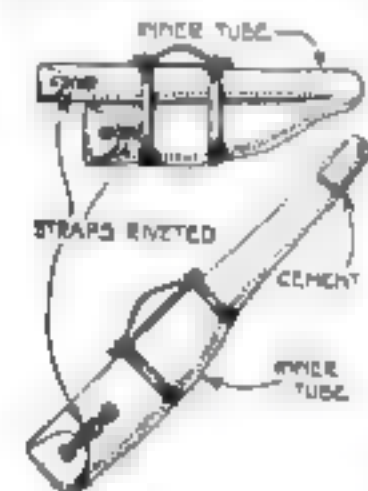
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Transforming an Inner Tube into a Gun-Case

FROM an old inner tube in good condition a serviceable gun-case can be made which will protect the gun and spare parts from possible injury from rain or contact with hard objects.

If the barrel of the gun cannot be separated from the stock, the case can be made without difficulty.



Two types of inner tube gun-cases

One end of the inner tube is closed, the other end that extends beyond the stock of the gun is turned over and fastened with a strap riveted to the tube to prevent it from becoming lost. To carry the case, a shawl strap may be riveted to the tube.

If barrel and stock are separable, the tube may be bent in U shape, one part of the U serving for the barrel or barrels, the other for the stock.

Both compartments are provided with flaps, closing the ends securely, and the case is carried by means of a shawl strap riveted to one of the legs of the U.

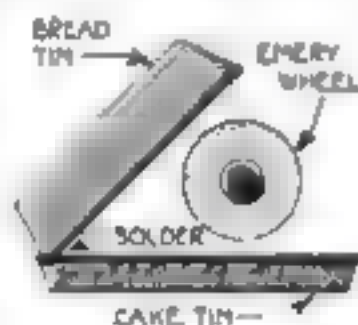
Emery-Wheel Dust-Catcher Made of Baking-Tin

A DUST-CATCHER for use with a jeweler's or dentist's emery- and buffing-wheel can be cheaply made of two baking-tins in the manner shown.

Buy a shallow cake-tin and a bread-tin of the same width. Invert the bread-tin, which is the deeper, over the cake-tin and solder these inverted ends together so the top tin forms an angle as illustrated.

When this is set under the wheel, the dust will be caught by one or the other and deposited in the bottom.

For dentists, who use much platinum, gold, and silver, this is an idea that will facilitate the saving of the precious metal dust.—L. B. ROBBINS.



The dust of ground metals will be collected by the pans

Protect Overalls in the Battery Room

IN the storage-battery repair-shop or charging station, the splashing of the sulphuric acid rapidly eats holes in the workman's overalls or jumper. Acid will not attack wax or paraffin and for this reason the clothing can be protected with a thin coating of these substances.

To apply the protective coating, either heat the wax or paraffin enough to melt, and dip the garment into this, or dissolve the paraffin in gasoline, making a thick solution into which the clothes are immersed and afterward allowed to dry thoroughly.—G. A. LUKAS.



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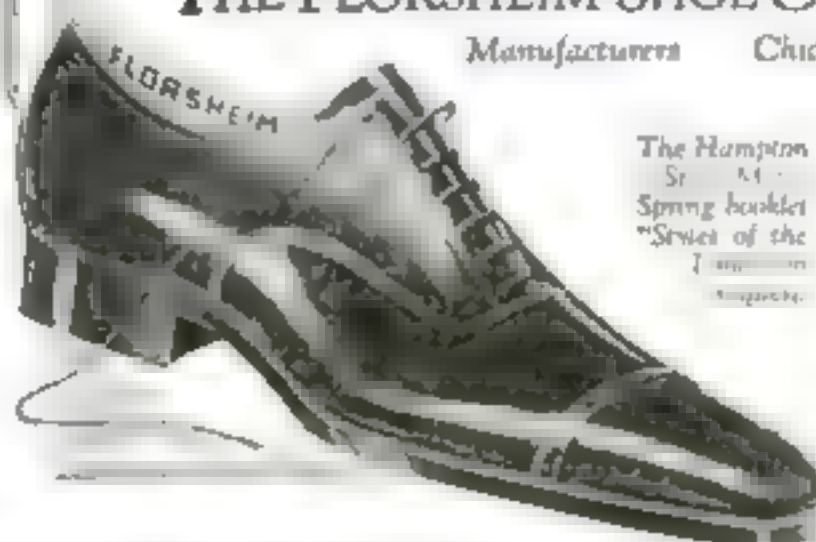
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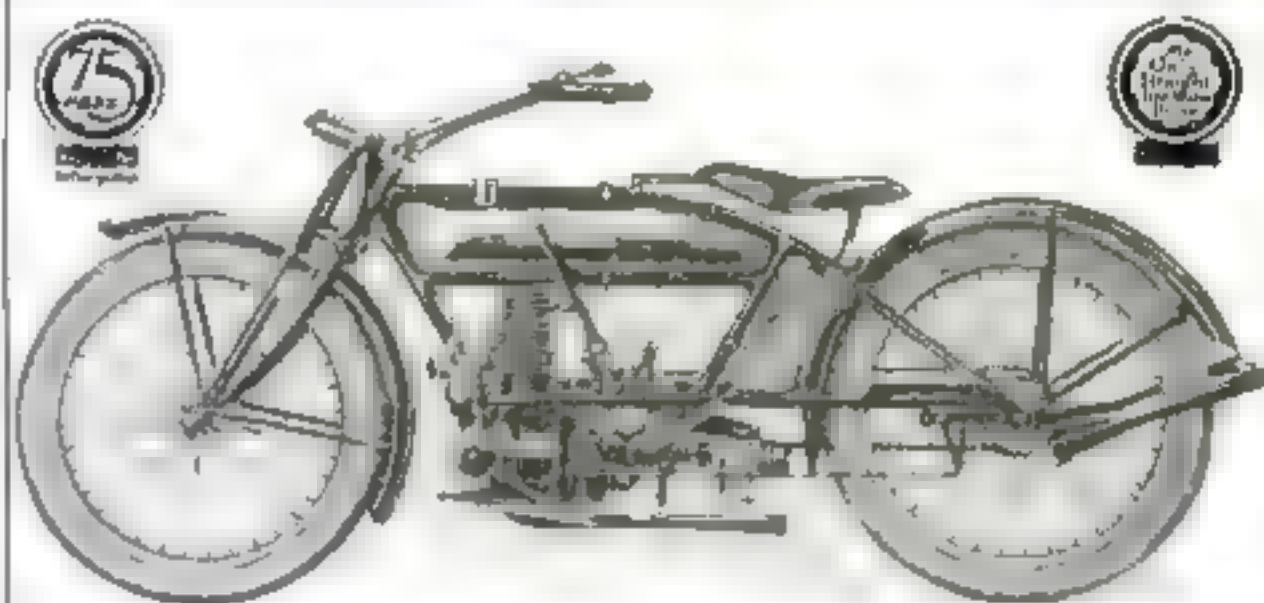
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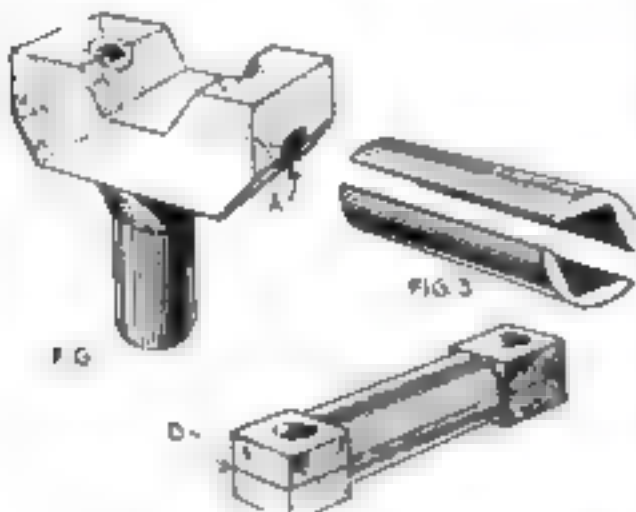
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Broaching a Hole without a Broaching-Machine

THE method here illustrated and described is of special value to the small shop or experimental laboratory equipped with only the ordinary light machinery.

Figure 1 almost explains itself. A broached hole may be practically any shape. The hole shown in the box tool illustrated is square. The first operation is to drill and ream A, say $\frac{1}{4}$ in. for a $\frac{1}{2}$ -in. square hole. The two bars to be used for the frame of the hole should be made as



Here is a simple method for broaching a hole without a broaching-machine

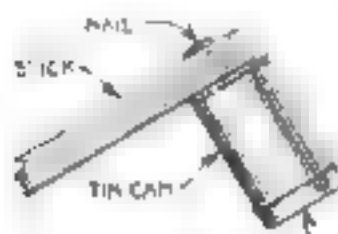
shown in Fig. 2, and planed true at surfaces marked B, and then bolted together. The two should be long enough to allow for bolting and turning a little longer to allow for trimming.

After the pieces are turned to a diameter slightly larger than the hole in the body pieces (say .003 in.), they may be placed on a milling-machine table. The ends of the pieces that have been left square can be used to line up the pieces and will also prevent them from rocking. This work may also be done on a lathe equipped with a milling attachment. When the grooves are cut, the pieces may be cut off a trifle longer than the body hole, to allow for trimming, as shown in Fig. 3.

The snugest and firmest fit can be obtained by shrinking the pieces into position. This is done by heating the body piece, thereby causing the hole to enlarge. This will actually permit a piece larger than the hole itself to be fitted more easily than by a driving fit alone.—P. W. HARTH

Save a Backache When Sowing Seeds

WHEN sowing small seeds in beds, where ordinarily there is much reaching, good, even distribution is easily accomplished by using a tin-can seeder. Any



COVER PERFORATED
Avoid a backache by using this seeder

round tin can, so long as it has a tight-fitting cover, will do. Cocoa and baking-powder cans are the commonest types available. The cover of the can is perforated with many round holes, the size varying

with the particular seed to be sown. This tin can is attached by the bottom to a strong, stiff stick two to four feet long.

In use, the seed is placed in the can, the cover screwed tightly on, and the stick and can held with the perforated cover down.

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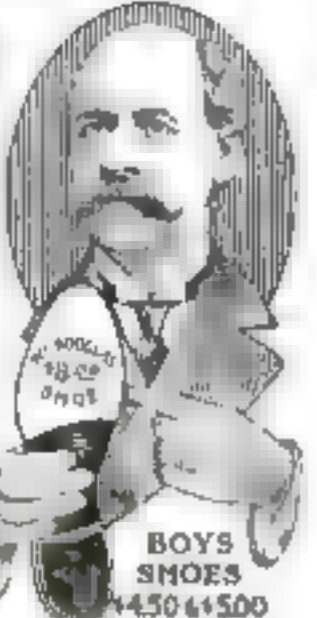
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To Make an Umbrella Drain-Stand

THE picture shows a useful article that a boy can make out of material offered by a discarded wooden bedstead or other old piece of furniture. A study of the perspective view will make the joining and construction clear and furnish necessary dimensions.

First mark out and saw the sides. If you wish to make the three-cornered hole in the center of each, you must bore three 1/4-in. holes and saw the intervening part with a coping-saw. A serviceable saw may be purchased for twenty-five cents.

Figure 4 shows how each end piece is mortised to the corner uprights. This joint is glued. Figure 2 shows how the top cross piece and uprights are fitted together. It is a very strong and neat joint, but requires considerable patience to get an accurate fit. The half cuts are made with a back-saw and the wide wood chisel. The baseboard fits between the front and back pieces. Figure 3 is an enlarged view of this joint.

Fancy wooden pegs or large metal hooks may be used as rests for the umbrellas. Glue is used at all joints. I think liquid glue is the handiest for amateurs to use.

In assembling this drain-stand, the sides and corner uprights are first put together, the top and bottom cross-pieces and the

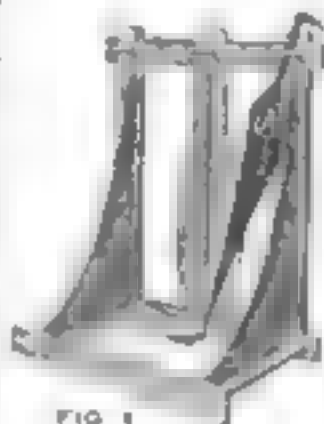
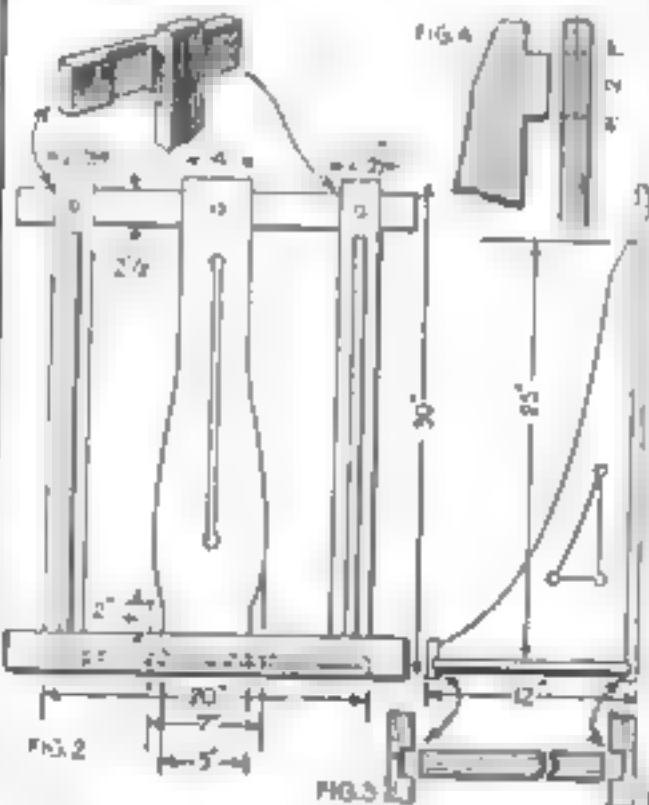


FIG. 1

The finished stand is ornamental and useful



An amateur carpenter will have no difficulty in making this piece of furniture

middle upright come next, and lastly the bottom face piece and floor

A metal pan should be used to catch the drip. Holes are bored for the wooden pins, which are 1/4 in. in diameter and 4 in. long, and they are also glued in place. The floor is screwed from the under side to the ends. The finishing is a matter of choice. For new, hard wood like oak you will need in the order named, a thin coat of stain, then wood filler, then stain, then either varnish or wax. If used on a side or rear porch, two coats of green wagon paint would be appropriate.—H. ADLON.

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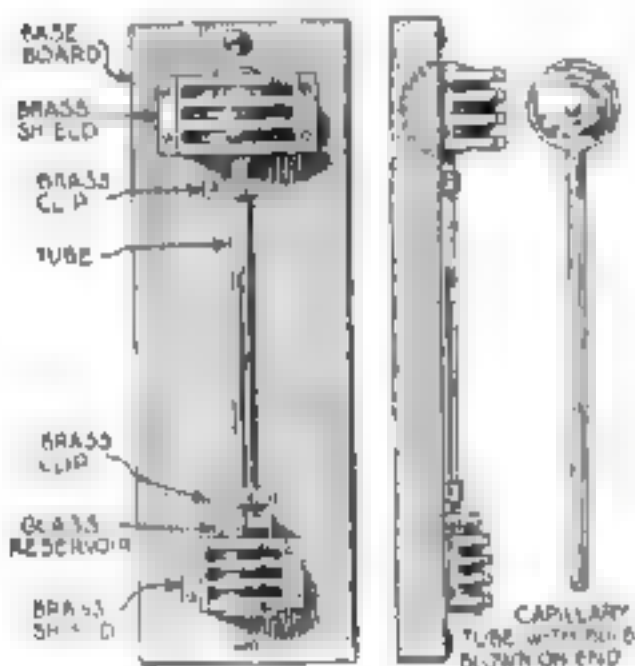
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Making an Air Thermometer for Experimental Use

A CAPILLARY tube of not over 1 mil. bore, or a regular thermometer tube, is used and the bulb blown at one end, the other end being left open. The length of the tube can be 8 to 8 in., allowing some for the bulb.

To blow the bulb, the end of the tube is held over a gas flame until red hot. Then the pliable glass is pushed up to thicken the end and form a mass of material from which to form the bulb. Blowing this, especially to a large diameter, requires some practice and skill, but should the bulb break, the glass can be melted together again and the attempt repeated.

The tube is mounted on a wooden board with the bulb at the top, the end extending into a small glass reservoir made from a small-diameter test-tube or from a medicine vial with the top cut off. Grooves are cut in the wood block for the bulb, tube, and reservoir, these are held in place by brass



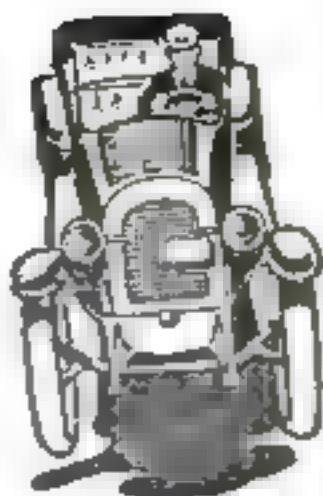
This air thermometer is not an actual temperature recorder, but it will show slight variations as well as a real thermometer.

clips, and as the bulb is exceedingly fragile, it is a good plan to protect it with a brass shield cut to shape as shown.

Mercury, while it is the most permanent would be too heavy for use in an air thermometer of this kind; alcohol, dyed red, is suitable, though water would answer the purpose.

To fill the tube, the bulb is held in the hand for but a few seconds to warm it slightly and expel some of the air. Then if the end of the capillary tube is quickly inserted into the liquid in the reservoir, some of it will be drawn up the tube as the air cools and contracts in the bulb. Should the liquid fill the tube and run up into the bulb, it must all be driven out by warming the bulb again and the operation repeated until, under normal conditions, the colored liquid stands about two thirds up the tube. A little experience of this sort will quickly demonstrate that the larger the bulb and the smaller the bore of the tube, and the lighter the liquid used, the more sensitive will be the action of the thermometer.

The reservoir being open to the air, evaporation will occur to some extent and the liquid must occasionally be renewed. This instrument, not being intended for an actual temperature recorder, but only to indicate small changes, no scale is shown attached to the board, though an arbitrary one could be very easily used if so desired.—H. H. PARKER.



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Sunshades and Branches to Attract Fish

THE inshore waters of lakes bereft of bottom vegetation, weeds, etc., that offer shelter and protection, invariably are poor fishing-grounds. If vegetation of one sort or another is brought into such waters the fish will be attracted and good fishing will therefore be the result. The drawing shows a method of attracting fish that has proved successful in ten lakes in which it was tried.

A float is made of boards or old planking six feet across and rounded. Holes are made in its center to permit a rope being tied to it. To this rope is tied a weight, which is dropped to the bottom. A little slack is given the rope so that when the lake is wavy the float will ride well without pulling up the stone anchor.

Around the float nails are driven into the edges at intervals. To these, wires are



Bowers of branches suspended in shallow waters will attract the fish

fastened. Branches, preferably some that will reach nearly to the bottom, are tied to the wires so that the whole forms a wide-spreading cluster of greenery. If a number of these floats are set here and there in a bay, the fish will soon be attracted to them — R. P. LINCOLN

Moth-Balls Are Useless as Fuel-Savers

MOTH-BALLS may keep the bugs out of your overcoat and fur, but, according to the United States Bureau of Standards, they are of no use in aiding the power of your automobile engine.

The market has been flooded with preparations that smell like moth-balls, probably taste like moth-balls, and perhaps are moth-balls. At least they are a naphthalene product, as are moth-balls. These preparations are highly recommended by the manufacturers and dealers as an enemy to the high cost of gasoline, but the success reported by the users is not due to the naphthalene at all, but to compliance with the simple instructions for the adjustment of the carburetor.

In testing out a number of the various so-called gas-savers, the bureau found that they had no appreciable effect on the economy of an engine, but that some of them did seriously affect the valves by fouling them.



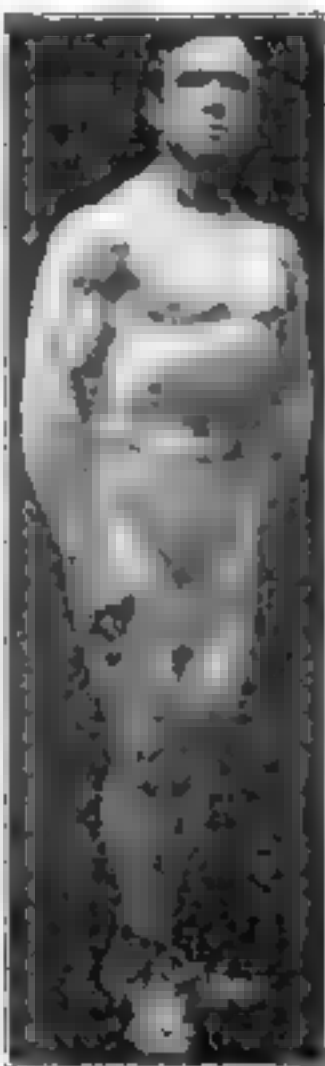
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The foundation of your success and happiness in the home, society, business, everywhere lies in a strong, healthy, vigorous body, filled to the brim with vitality and robust health.

Weak, sickly, anemic misfits have no chance in the battle of life. They can never win because they haven't the strength, pep and vigor to get started. Sympathy for weakness is polite contempt. You don't count if you are not physically fit. The strong, healthy, vigorous man is the popular man—the man whom everybody wants for a friend. Success is the Gift of the Strong—physical weaklings must take what is left over and fall back with the defectives and tail-end failures.

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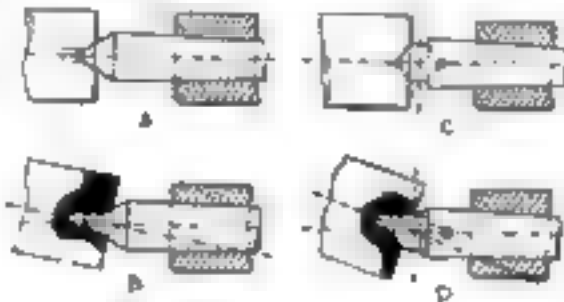
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angle of the taper, owing to the effects of the wear, constantly changes and the cut becomes inaccurate.

An English mechanical engineer suggests as a remedy the use of spherical centers as illustrated in Figs. C and D. The end of the tailstock is provided with a cup-shaped recess into which a ball of hardened steel fits with accuracy. Instead of the conical recess that usually forms the center of the



The effect of taper-cutting with the tailstock out of alignment is shown.

object to be turned, a similar cup-shaped recess is sunk in the end of the piece.

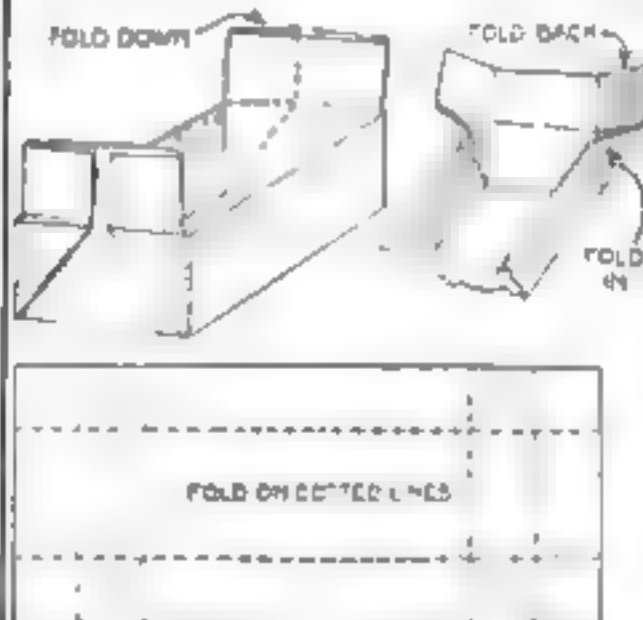
Figure C shows the position of the parts with the tailstock in perfect alignment with the center of the headpiece. Figure D illustrates the relative position of the parts in cutting a taper at a considerable angle.

As will be seen, there is no interference and no probability of excessive wear that might disturb the angle of the work while the cutting is done.

Paper Boxes for Domestic Use Are Easily Made

FREQUENTLY you are in need of a paper box and cannot find one already made of the required size and shape. By following the directions illustrated in the accompanying diagram, you will be able to make your own paper boxes tight enough to hold solids, even in powder form, and if made of paraffined paper, capable of holding liquids.

First ascertain the exact dimensions of the box you need, then mark on a sheet of



Paper boxes folded as illustrated here form useful containers.

very stout packing-paper or paraffined stock, a line for folding in accordance with the diagrams in the lower part of the illustration.

After all the lines necessary have been drawn, crease and fold the paper as shown in the upper part of the illustration.

It is obvious that the dimensions of the box may be varied to suit the requirements in each case, once the principle is understood.—PETER P. LEMBO.

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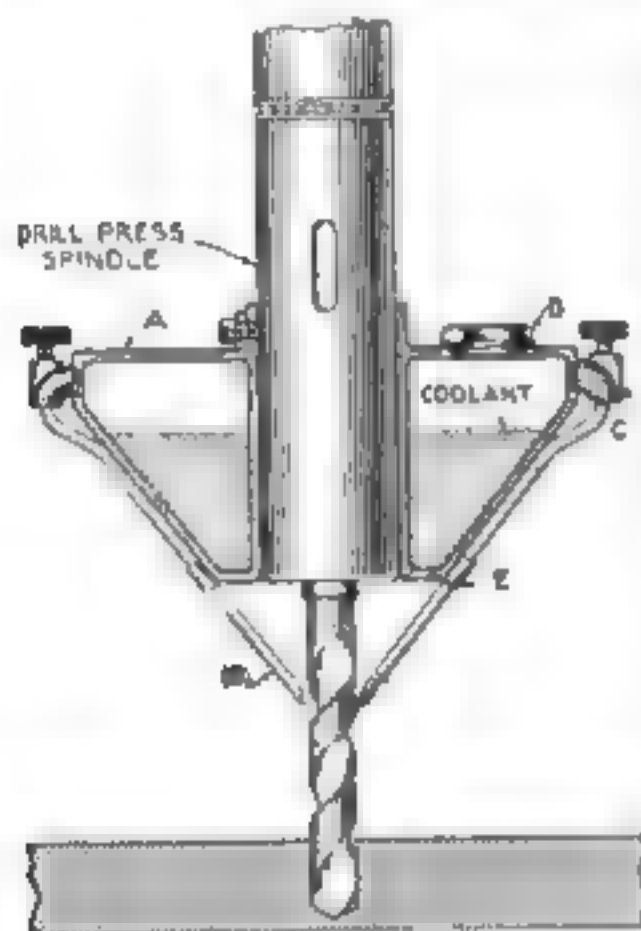
POPULAR SCIENCE MONTHLY

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Automatic Coolant Feed for a Drill-Press

TO-DAY all shops use a "coolant" of emulsified oil or in some few cases straight lard oil for cooling the drill and aiding the cutting in drill-press work. One of the disadvantages of the usual gravity feed or pump feed is that the operator will go away from the machine at night and forget to turn off the oil, causing waste.

The illustration shows a device designed by the writer to overcome this trouble and to put such apparatus in the automatic class. It is designed to be attached to the spindle of the drill-press. A is the tank or receptacle proper of cast iron bored out to take the spindle, and held up in place by a set screw. B are two copper tubes of 1/2-inch diameter soldered on one end to the needle-valves C, the other end leading to



The cooling oil, supplied to the feeders by centrifugal force, will be fed to the drill only when it is working

the drill. These tubes are secured to the tank A by clamps E. D is a filler plug for replenishing the supply of coolant.

The action is as follows: Start the machine and as the spindle starts to revolve, the centrifugal force throws the coolant out to the largest diameter of the tank, thus overcoming the force of gravity and forcing the coolant against the ports of the needle-valves C, from whence gravity acts.—W. B. R. BENNETT

Avoid Shellac and Save the Cylinder-Head Gaskets

THE copper-asbestos gaskets used under the heads of detachable head motors, invariably stick so solidly when these are put on with shellac, that removal of the head for cleaning out carbon necessitates loosening the bolts or nuts holding the head on about two turns and starting the engine to shake or lift the head sufficiently to remove.

A more satisfactory and correct method of putting on these cylinder-head gaskets is to coat each side with cup grease or, better yet, graphite grease. This does not harm the gasket and a positively water- and air-tight joint is certain.

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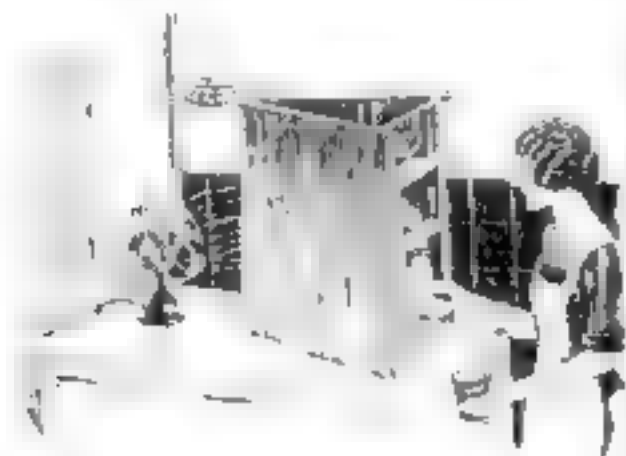
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An Iceless Refrigerator for the House

THE arrangement shown is made of a 1/2-in. pipe frame, covered with cloth. The top pipes on which the cloth is hung has small holes drilled about 4 in. apart on the bottom sides. When the can is filled with water, or the city water turned on, the cloth becomes saturated with water. The



Rapid evaporation of the moisture in the cloth of this cabinet causes the temperature within to fall

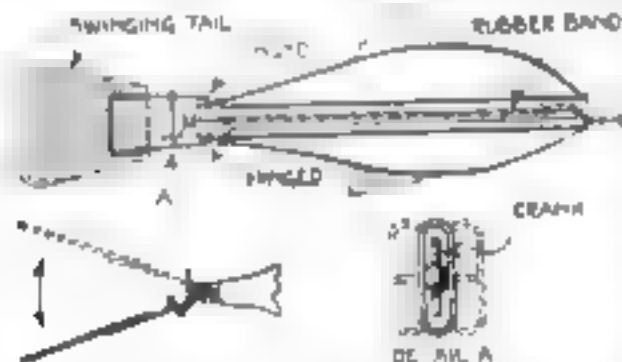
draft from the fan creates a rapid evaporation, which greatly reduces the temperature inside the cloth.

The frame is made triangular in shape so as to present the greatest possible evaporating surface to the draft from the fan. The opening in the cloth is made on the side opposite the fan. The shelves can be arranged to suit the individual need. With a positive draft assured by use of an electric fan, the arrangement shown will prove to be a reliable cooler.—F. G. KOPPEL

Make This Mechanical Toy Fish that Swims

A MECHANICAL swimming fish can be made with very little trouble. The untwisting of a rubber cord causes the flapping movement of the tail so as to propel the fish through the water on the same principle as used by the real fish. The rubber cord or band is stretched between hooks on two spindles.

The front spindle has the shape of a crank that comes out of the fish's mouth and serves for winding up the rubber band. At the other end is a crank-shaped piece



This toy fish is propelled through the water by the motion of its tail, a twisted rubber band supplying the power

that rotates when the rubber band unwinds, and this produces the back-and-forth motion of the fish's tail.

The end of the crank works in a loop of wire in the shape of a slot, so that the revolving movement of the crank produces a to-and-fro movement of the hinged wire part, as will be readily seen in the drawing. On this wire frame is mounted the tail, which flaps back and forth so long as the cord untwists.

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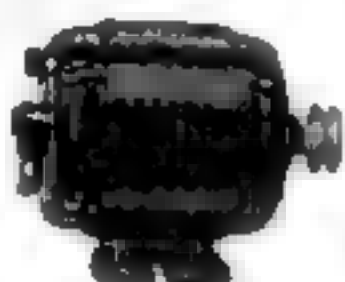
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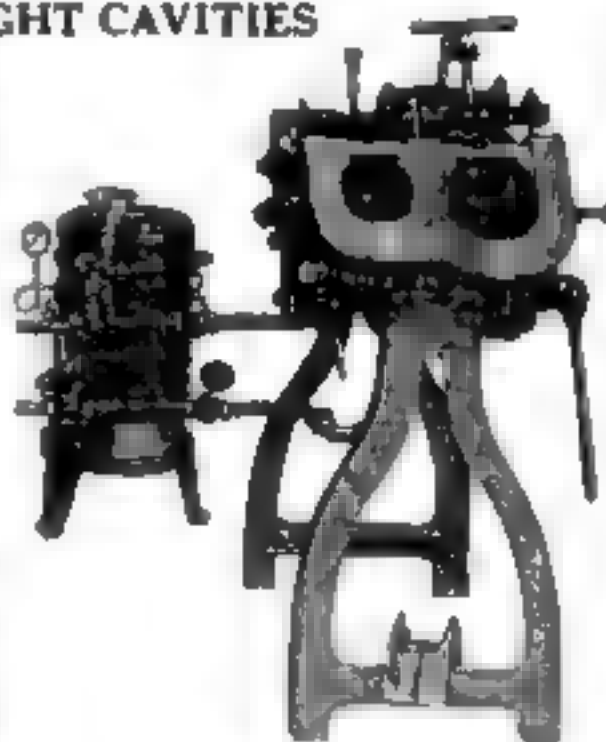
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Finding New Uses for Old Things

What use have you for some of the "junk" in the attic or cellar? Popular Science Monthly will pay ninety dollars for the best answers

THERE is the old baby-carriage, the old stove, the old bureau, the trunk, and the leaky wash-bowls. The attic also contains old phonograph needles, safety-razor blades, carpets, curtains, chairs, tables, picture-frames, hat-boxes, etc. Have you been able to save money and add a convenience to your home by pressing some of these things into service again? If you have, you probably had to get the household tool-kit out to help you. Sit right down now and tell Popular Science Monthly what changes you made and how you made them. It makes no difference what you changed, as long as it was old. You may win one of the prizes.

The Popular Science Monthly offers three prizes for the best answers—a first prize of \$50, a second of \$25.00, and a third of \$15.00. These will be awarded in accordance with the rules outlined below.

Rules Governing the Contest

(1) Contestants are not limited to the number of ideas, but only one method can possibly win the first prize, only one the second, and only one the third. The contest is open to everybody.

(2) The use of the old piece of junk must be shown clearly, either in a photograph or in a drawing. If a drawing is sent in, it need not be made by a skilled draftsman. It is sufficient that it should be intelligible. While pencil sketches will be considered, contestants are requested to make their drawings in ink on heavy white paper. The views should be sufficient in number to set forth the writer's idea very clearly. The contestant's name and address should appear on each sheet of drawings.

(3) The drawings or photographs must be accompanied by a description, preferably typewritten, in which the method is clearly given. It must be written on one side of the paper only, and it should not be more than 500 words in length. The name and address of the contestant should appear in the upper left-hand corner of the first sheet of the written description.

(4) The drawings and description entered by contestants must be received by the Popular Science Monthly not later than 5 p. m., on June 15, 1921.

(5) The judges of the contest will be the editors of the Popular Science Monthly.

(6) The first prize of \$50 will be awarded to the contestant who, in the opinion of the judges, has suggested the best use for an old piece of junk.

The second prize of \$25 will be paid to the contestant who submits an idea next in merit.

The third prize of \$15 will be paid to the contestant who submits an idea third in merit.

(7) The winners of the contest will be announced in the earliest possible issue of the Popular Science Monthly. A description of the ideas that win the three prizes offered will duly appear in the pages of the Popular Science Monthly, together with the names of the winners.

(8) The editors of the Popular Science Monthly shall have the right to publish meritorious manuscripts that do not win a prize. The regular space rates will be paid to the contestants who submit the manuscripts thus selected.

(9) When a contestant submits more than one idea, the description and drawing by which each is set forth must be sent as a separate unit.

(10) Manuscripts or drawings will be returned to contestants if stamps are enclosed.

(11) Send drawings and specifications to the Editor of the New Uses for Old Things Contest, Popular Science Monthly, 225 West 39th Street, New York City.



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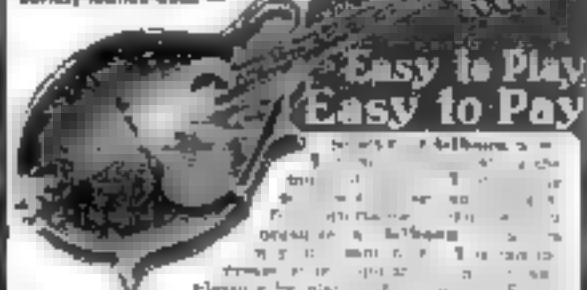
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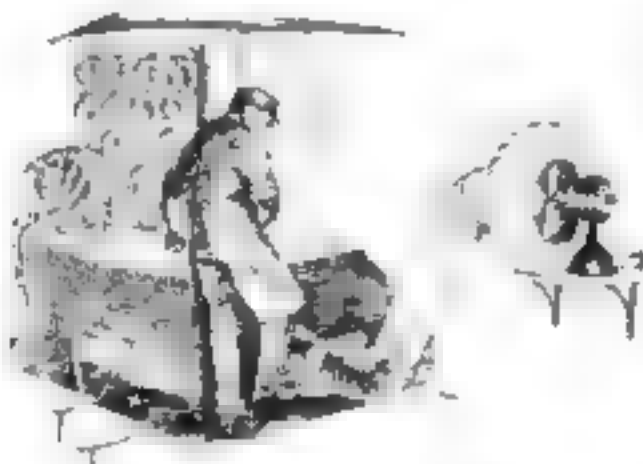
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An Electric Blower for the Blacksmith Shop

AN electric fan was employed on a blacksmith's forge to relieve the blacksmith from turning the blower by hand.

Four stove-pipe elbows were cut in half, soldered together, and used as the casing for the fan blades. More stove-pipe was used to convey the air to the forge. To regulate the pressure of the blast, a slot was cut in the side of the pipe, just wide enough to let a flat piece of tin slide through. This piece of tin was provided with a handle for the purpose of moving it in and out. A



An electric fan will supply a steady draft to the forge fire, leaving both hands of the blacksmith free.

gate, projecting from the pipe at right angles, was fastened on the pipe just over the slot. This gate supports the slide when it is pulled out and allows the maximum pressure of air to flow through to the forge.

By changing the position of the slide, the fire in the forge can be regulated to suit the mechanic.

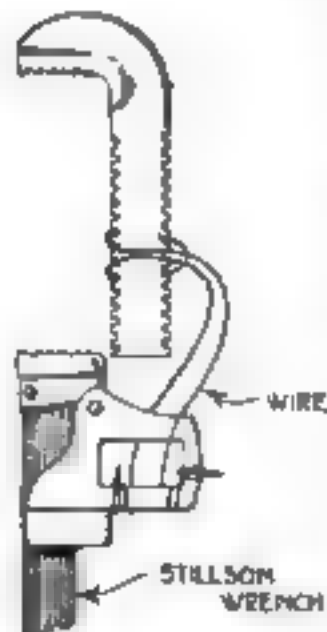
This arrangement leaves both hands free to use tongs or any other tools that may be wanted. When the gate and slide is placed near the floor, it can be operated with the foot.—R. C. SMITH.

Improvise an Extension Wrench for Large Work

OCCASIONALLY plumbers or steamfitters, though well equipped with tools, are confronted with the difficulty of removing pipe joints too large even for their largest wrenches. The accompanying picture illustrates how a wrench of inadequate size may, in an emergency, be

extended to grip the large screw joint.

A piece of stout wire is looped around the movable part of the jaw of the wrench, while the other ends of the wire are firmly twisted around the rocker of the handle. By this expedient the capacity of the wrench can be extended easily from $\frac{1}{2}$ in. to 1 in., according to the size of the wrench and the diameter of the pipe.—W. M. JACKSON



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The contrivance consists of an improvised electrical contact to be attached to a bell circuit. The contact may be made to



When baby is restless, the movement of the carriage rings an electric bell

suit the individual style of carriage, but the writer made one which works very well.

On a block of wood about 3 in. square attach a spring in spiral form, about $\frac{1}{2}$ or $\frac{3}{4}$ in. in diameter, to which is attached one wire of the circuit. An appropriate hook or means of easily slipping this block on or off the carriage should also be provided. Then attach the other wire of the circuit by a wood screw and washer to an ordinary wooden clamp. The clamp is so placed as to come directly over the spiral spring and the slightest shake of the carriage will cause a contact between the washer on the clamp and the spiral, causing the bell to ring wherever desired.—J. J. GINSBURG.

Why Not Weave a Mat from That Old Tire?

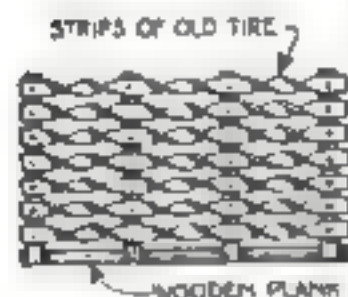
IN the country where the roads and foot-paths are sometimes muddy, a good foot mat is needed for the front porch. The old auto tire makes an excellent mat for cleaning mud from the soles of shoes.

The old casing, after being cut in two at the weakest point, is cut into strips about 1 in. wide and as long as the sound part of the tire will admit. All rubber that will adhere to the fabric is left on.

The base for the mat can be made from the end of a packing-case or a piece of wide 1-in. board. Two boards properly cleated together will answer.

The strips are nailed to the edge of the baseboard, and then brought across the face and nailed to the other edge. If the

strips are twisted about three turns as they are brought over the face of the baseboard, the mat will be more satisfactory. Spaces of $\frac{1}{4}$ to $\frac{3}{4}$ in. should be left between strips. Where the strips lie flat on the baseboard, nails should be driven through and clinched on the other side. If strips are not twisted, they should be nailed about every 4 in.—E. E. LAMB



Twisted strips of an old tire make a mat

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Adapting a Small Lathe for Shaping

By H. H. Parker

A WELL known lathe stunt is the cutting of a keyway by placing the shaft between centers, setting the tool upon its side in the toolpost and then moving the carriage back and forth by hand, feeding the tool in a little after each cut. This is a slow and inefficient method, but the principle is capable of being elaborated by the addition of a few attachments that will convert a small lathe into a hand-power shaper able to handle a large variety of light work. The application to a medium or large-sized lathe would be hardly practicable, unless a special light carriage was built, for the regular carriage, being rather heavy, would require most of the motor power of the operator to move it back and forth.

The illustrations show a hand lever as fitted to an old 10-in. Bernos lathe but no dimensions are given, for these, as well as constructional details, would differ with every make of lathe. An oak plank is mortised to fit over the lathe-bed and clamped to it by means of two iron or steel plates, one of which is removable, the sleeve being used only to bring the clamping-nut within convenient reach under the bed. A long iron or steel lever is pivoted at the rear end of the oak plank and at about 12 in. from the fulcrum a short link is bolted which in turn connects with a stud bolted to the carriage. Two or more links, of different lengths, may be provided for work requiring short or long strokes.

If possible, the carriage hand wheel or handle and pinion should be removed, so the device will then be easier to operate. The work is held between centers and the tool upon its side in the toolpost, as described above, the feed being given through the cross-feed handle.

Gears and ratchets sufficiently accurate for many purposes, may be cut without a special index by mounting a master gear of the same diameter and number of teeth as the one to be cut, on a mandrel beside the blank. A tool is shaped to fit as accurately as possible in the tooth space of the master gear, while in the toolpost and while in this position, a stop is placed on the tool slide

so that the tool cannot be fed in beyond this depth. The mandrel must be capable of rotation by hand between cuts, but during the cutting it is clamped by a steady rest or other means. The tool being set in a tooth space of the master gear, it is withdrawn by means of the cross feed and then gradually fed in while taking a cut on the blank, if the mandrel is securely held, the whole depth can be cut until the stop is reached, without injuring the master gear. Then the tool is set at the next tooth space and so on until all the teeth are cut.

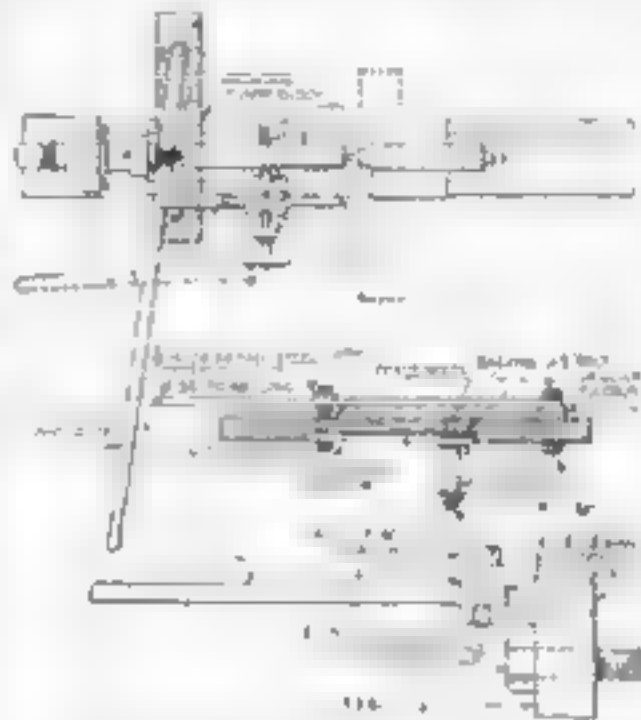
By removing the cross-feed screw and reversing the wood block, turning the lever around parallel to the lathe-bed, as indicated by the dotted lines in the illustration, a transverse motion of the tool block instead of the carriage may be obtained, for end shaping of work held in the faceplate, though in this case the link stud must be attached to the tool-block instead of the carriage.

A small shaper head, built with a shank to be clamped into the tailstock barrel, will further

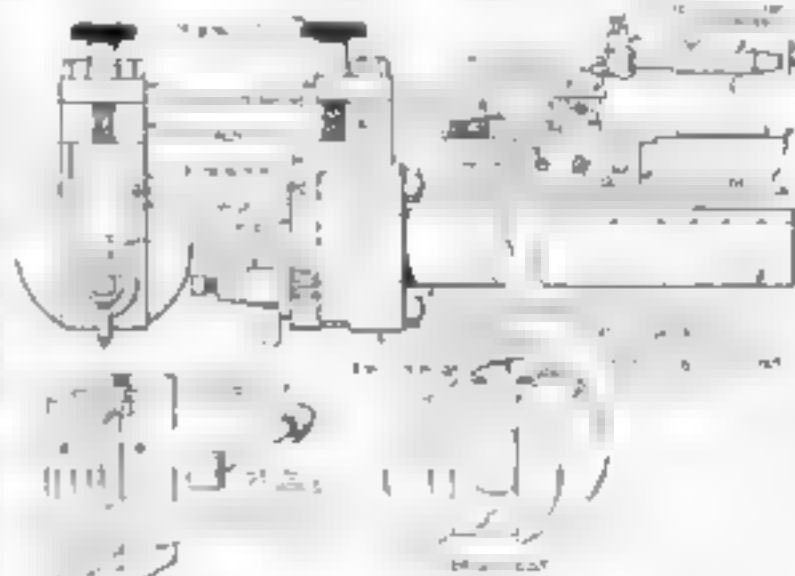
increase the usefulness of the lathe-shaper equipment. In using this device, the work would be clamped to the tool-block and moved back and forth under the shaper tool, the latter being provided with a vertical slide similar to that found on a regular large shaper. The illustration shows a miniature shaper head built up without castings, with a vertical movement of about 1 in.; a small clapper block relieves the tool on the reverse stroke. If possible to remove the key in the tailstock barrel, the shaper head may be rotated to any angle.

A further addition would be an angle plate or column to bolt to the tool-block, similar to the lathe milling attachments. This would be provided with a vertical slide of substantial construction that would carry the shank of the shaper head just described. Such a device would allow the work to be held be-

tween centers on the faceplate, on a small table or vise bolted to the lathe-bed, or to the lower portion of the tailstock. If of the "set-over" pattern, the barrel being removed. The latter forms a most convenient table for clamps or a small vise.



This attachment to the lathe will cut keyways as well as gears and ratchets with sufficient accuracy.



Other attachments that will increase the usefulness of your lathe for shaping are here illustrated.

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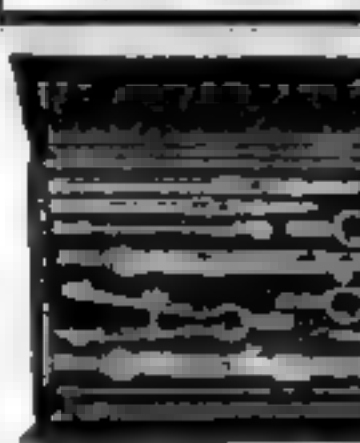
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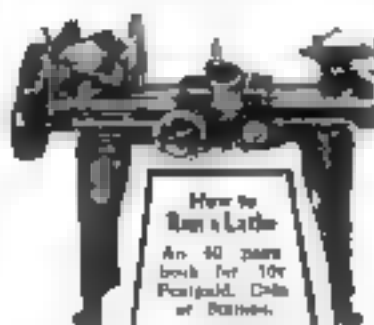
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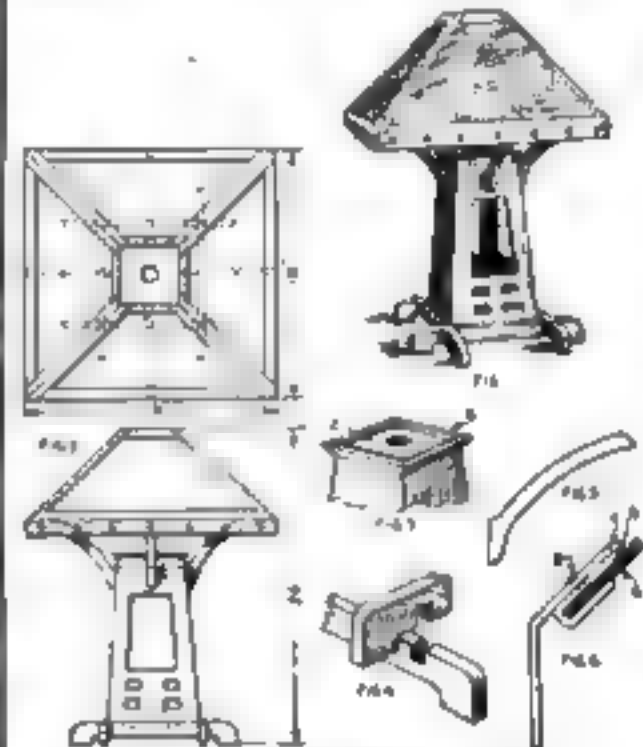
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THE body of this lamp is made of four 1 1/2-in. boards fastened together to form a tube 7 in. square at the base and 5 in. at the top. Openings are cut in the boards for lighting the lamp and to add to its beauty. The square opening at the top is covered with a lid that has a hole 2 in. in diameter in the center. It is marked C in Fig. 5. Around the top, fasten plain molding, B.

The base is made of four strips joined as in Fig. 4. The strips forming it are screwed to the body with round-headed brass screws. The shade supports, Fig. 6, are



Why not make an ornamental lamp? Here is how it can be done.

also screwed in place. The shade frame is made of oxidized copper strips averaging 2 in. in width. The inside ends are bent into hook form to receive and hold the art-glass filling. Figure 8 is a section of the

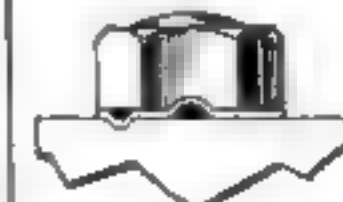
The copper strips are riveted together, and when the work is completed, should be nicely lacquered.—T. ADLER.

A Very Simple Way to Lock a Nut

IN replacing a bolt on a piece of machinery, it was desired to provide some means of locking the nut in place. The bolt was not long enough to allow the use of the ordinary lock washer, and on account of clearances it was impossible to use a longer bolt. The improvised washer shown in the illustration was used with good results.

Across the bottom face of the nut, a slot was filed about 3/16 in. deep. The surface against which the nut fitted was treated in a similar way, the slot being chipped to about the same depth. A washer was cut from light sheet metal to fit the bolt, its outside diameter the same as the distance across corners on the nut. The nut was tightened in the usual way. The metal of the washer was then forced into the grooves with a small punch.

The nut was locked securely from turning either way and proved entirely satisfactory.—L. R. BUTCHER.



One of the simplest ways of locking a nut

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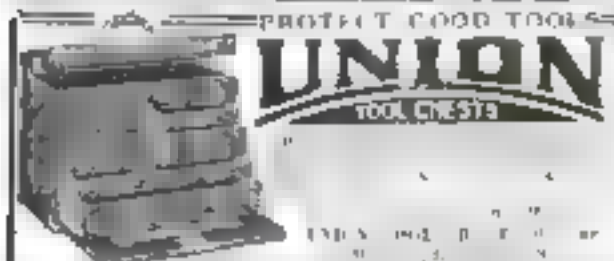
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Circular-Saw Attachment for Bench-Grinder

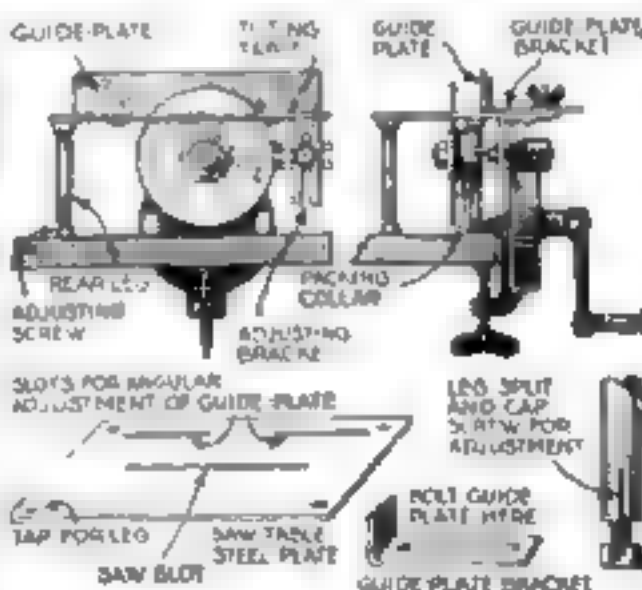
THE sketch shows a useful attachment for a small hand-power bench-grinder that converts it to a hand-power circular saw and the home mechanic will soon find many uses for one. The grinding wheel is removed and a small saw clamped in its place usually a packing collar will be required to make up for the narrow width of the saw.

A saw-table is made up of steel or iron plate about 1/2 in. thick, or, lacking this, a maple or other hardwood board will answer the purpose. This table is made tilting by screwing two legs at its rear end and a slotted bracket at the front end. The bracket is bolted, with a thumb-nut, to the grinding-rest bracket provided with the grinder.

As the legs rest directly upon the bench, to allow for any unevenness of its surface, a cap screw is screwed into the lower end of each leg and to obviate the use of locknuts, the legs are split and pressed together before inserting the cap screws. They will then enter tightly and will not work loose.

For light sawing, this being all that the attachment is designed for, the table will be firm enough, though if thought necessary, the legs could be attached to two small angle brackets screwed to the bench, thus anchoring the table at three points.

A guide-plate, preferably with an angular as well as a parallel adjustment, will be



If you have a hand-power bench-grinder, you may easily convert it to a circular saw for small work.

needed, and an easily constructed one is shown. The plate itself is of steel or hard wood and is held vertically by means of two brackets bolted to it. The long horizontal bracket arms are slotted so that the guide-plate may be slid along the table axially with the saw and clamped in any position. To allow of angular adjustment, two slots are also cut in the saw-table through which the bracket bolts extend. These allow of the table's being shifted around at an angle with the saw.

Another way to rotate the guide-table would be to remove the bolt from one bracket and allow the table to swing on the other as a pivot.

As but one bolt and a thumb-nut are needed to attach the saw-table to the grinder and one more nut to clamp the saw in place, it will be seen that the attachment may be quickly set in place and removed, and for intermittent, light, accurate sawing, such a device is much simpler and more compact than a power-saw of greater capacity. H. H. PARKER.



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Build Your Own Photo-Printing Outfit

By Curtis Ralston

THE cost of getting photo prints made continues to rise, encouraging the amateur to do his own printing. With the ordinary printing-frame this is a slow process, by using some form of box printer the time is greatly reduced, but not every one has the ten dollars or more to spare for such a device. The writer, finding himself in just that position, got together a collection of odds and ends, and made the printing-box shown in the illustration.

As will be seen in Fig. 1, an old packing-box was the starting-point in the construction. A piece of glass was found just wide enough to fit in the groove in which the sliding lid works. Strips of black paper taken from a printing-paper package were pasted to the glass so as to form a mask. Several of these masks, of any desired size and shape, can readily be made if one has some pieces of picture glass and a cutter, but only one, of course, is necessary for one size of camera. The glass mask is inserted as shown, and the box-lid is brought up against it; this prevents all light from getting out of the box, so that unused paper can be kept at hand, uncovered, while printing.

Two electric lights are required, taking current from the 110- or 32-volt house-lighting system. The printing is done by an ordinary 25-watt clear tungsten lamp

socket is turned on for the required number of seconds.

For holding the paper and film against the mask, one may use the back of a printing-frame, if it is of the right size, or an old bath-towel, rolled up evenly and fastened with a safety-pin or two, is pressed firmly against the glass, holding the print and film in close contact. The right hand holds this pad, while the left operates the printing-lamp key socket.

In the box illustrated, the filament is about 4 1/4 in. from the glass, and the average time required for printing is about 3 seconds. Four or five prints can be ex-



The printing box open to show the arrangement of the two lamps, one a safe light, the other for printing

posed every minute. For timing prints, probably the handiest way, in the absence of a metronome or other timing device, is to count "thousand and one, thousand and two," etc., by comparing your counting with the second-hand of a watch, you can easily learn to count seconds in this way.

Certain precautions must be observed. If the box is small, and the lamps are left on very long, the wood will get very hot. For the sake of safety an asbestos lining may be used. The ruby light should be turned off now and then while getting films and paper ready for printing.



Here the homemade photo printing box is shown with the glass slide open to disclose the printing frame

placed directly under the glass; in Fig 2 a tubular lamp is shown, but there is no necessity for using this particular shape.

To the right is the second lamp, which is to serve as a red light to assist in placing the film and paper for printing. If one cares to expend seventy-five cents for a standard ruby lamp, it will be a little more convenient, but the writer uses an ordinary 25-watt lamp with two thicknesses of red ribbon around it, and finds it entirely satisfactory.

The keyless socket for the ruby lamp is held loosely in place by catching the cord leading to it in a screw hook; a staple would do just as well. A key socket is used for the printing-lamp, and is fitted snugly into a hole cut in the end of the box. The hole should be located at a distance of 4 to 8 in. from the top of the box, depending upon the size of the pictures to be made.

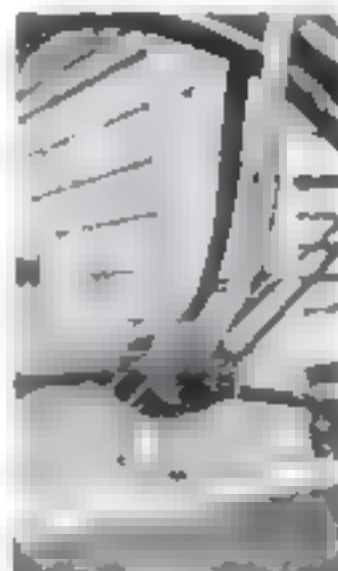
The center of the filament should come under the center of the open space in the mask. The socket should be placed, and the mask made, with this condition in view. The two sockets are connected, in parallel, to a cord running to an attachment plug. While using the outfit, the ruby lamp remains lighted continuously, when a film is ready for printing, the key

Keeping the Mud Out of the Bearings

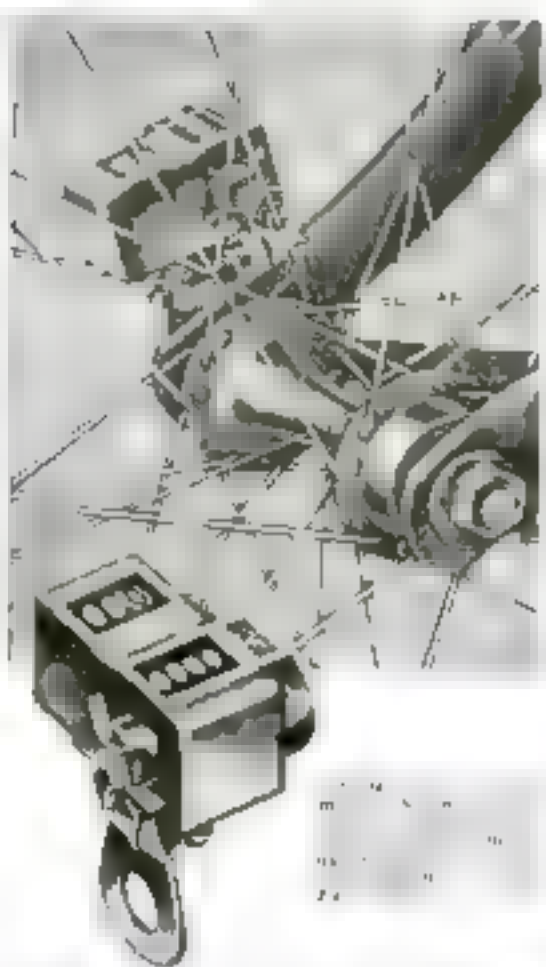
A LAD who twice daily supplied the people in his neighborhood with newspapers found that the mud and water that worked into the bearings of his bicycle wheels soon wore them down to such an extent that they needed new cones and balls.

To protect his wheels he cut washers of soft felt and fitted them over the bolt that runs through the axle of the wheels as shown. These washers were so soft that they in no way impaired the efficiency of the wheel, yet they were absorbent enough to take up what water and soft mud ran down the spokes.

Once a month or so, the washers were removed and washed out, and again put on. The illustration shows the washers attached to the hub of the front wheel.



Felt washers will keep water and mud out of bicycle bearings



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Illustrated at left is the regular model cyclometer for bicycles—familiar the world over. The instrument is dust and water-proof, has no spring in the mechanism, cannot "skip" or register too much. The figures are large and close to the dial—easy reading from the saddle. Registers up to 10,000 miles by tenths of a mile, then repeats. Price, \$2.00.

Veeder Cyclometers include models especially made for motorcycles, built stronger than the regular bicycle cyclometer, and designed to withstand the vibration and shocks of high-speed motorcycling. Price, \$3.50 and Harley-Davidson model \$4.00.

A little booklet giving off the points and illustrating the model of Veeder cyclometers, is free for the asking. You may get a like a copy of the Veeder Counter booklet showing counting mechanisms for other than bicycle purposes.

The Veeder Mfg. Co.,
44 Sargeant St., Hartford, Conn.

Removing Gears with a Puller

BELOW are illustrations that show the construction of a device which will be found useful around the small shop or garage for pulling gears, pulleys, or collars off shafting and a variety of similar work.

The body of the puller is made of a piece of square cold-rolled steel, drilled for the clamp-screw bushing and slotted as well as drilled for various sorts of pulling arms.

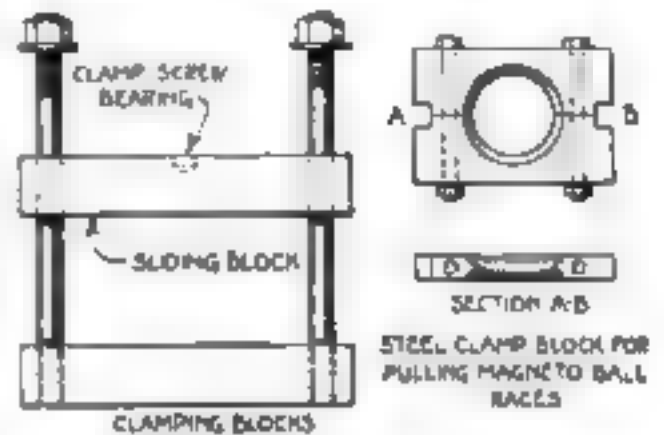
As there would be considerable wear in the threads of this kind of a fitting, a removable nut of bronze or gun metal is shown, being made a drive fit into the body and held by a small set screw. In case the bushing wears, it may be driven out and a new one substituted.

The screw has a square head for a wrench and it would be well to harden the head as well as the point. Sometimes the point will bear directly upon the work; at other times a thrust block interposed would be best.

Two types of thrust blocks are shown, one with a flat face, either roughened or smooth, and one with a V-groove for bearing against curved surfaces. The small

distance from the clamp screw. A steel plate yoke frequently is useful, especially if the center is drilled for slipping over a shaft, and the arms are drilled for the bolts serving as pulling arms. Such a yoke may be slipped behind a pulley or gear and the part removed without danger of damage that might occur if the arms were attached directly to the rim.

Another illustration shows a pair of clamp blocks and two bolts serving as arms



This clamp-block is very useful for pulling ball races from magneto shafts

and attached to the clamp screw block. One block slides and is drilled for a bearing to take the end of the screw; the other is drilled and tapped for the arms. Work is clamped between the fixed and sliding block.

To conclude, a small fitting is shown that has proved very convenient for pulling the ball races from magneto shafts. It is in two parts, bolted together and bored out to take the race, over which it is clamped while the puller arms fit into the end notches.

Such races are difficult to remove, without injury, unless some special fixture of this sort is used — H. H. PARKER.

A Dust-Cap to Protect the Machine-Oil Hole

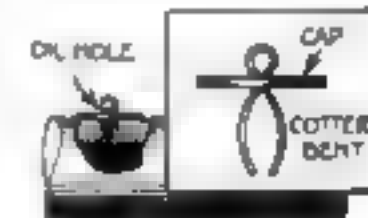
MACHINERY that is to be operated in locations where much dust prevails should have the oiling holes well protected from the outside air. This is generally provided for, but in the case of farm machinery the manufacturers sometimes overlook the importance of this item.

Following is a simple cap that can be quickly fashioned out of materials usually lying about any machine-shop or farm work-bench.

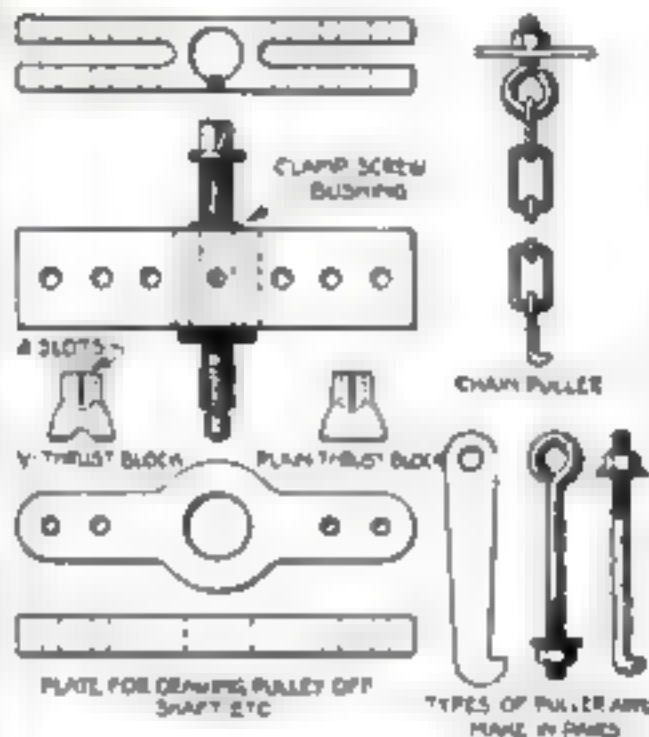
Cut enough round disks of stiff leather to cover the required number of oiling holes. Have them large enough so

they lap well over the edges—about $\frac{1}{8}$ in. in diameter, if possible. Punch a small hole in the center of each one.

Now take as many small cutter-pins as necessary and cut them off so that when thrust through the caps, the ends of their tines will not quite touch the shafting in the bearing. With small pliers, bow the tines outward as shown. They will then have to be forced gently into the hole and will successfully hold the cap down in place.—L. B. ROBBINS.



The cap keeps dirt out of the oil hole



Jig for removing gears, pulleys, or collars from shafting

ends of the thrust blocks are drilled to take the end of the screw and are slit in four places with a hacksaw. A groove is turned just above the point of the screw and the slit ends of the thrust block slightly bent in so that it will spring over the screw point.

The pulling arms are made in pairs; one form is a plain hooked type filed from flat bar steel with the upper end drilled for a pin.

Another kind is a hook bolt, the nut and washer bearing upon the top surface of the body and the bolt extending through the groove. Such arms may be adjusted for unequal lengths, if required.

Another form is the plain eye-bolt, either the eye is held by a pin through one of the drilled holes in the body, the bolt extending through the part to be drawn off and secured by nut and washer, or the bolt may be reversed, the eye being secured to the work and the nut bearing upon the body as in the case of the hook bolt.

Sometimes a couple of chains are more convenient than solid arms; the upper links may be held to the body by pins or by eye-bolts. Chains are adapted to irregular shaped work or for pulling a part at some

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The photograph shows how this is done by means of a strip of roofing-paper extending down inside each boot leg. This makes of the inside of the boot something of a flue and the air current goes down one side and comes up the other. Without this strip to partition the boot into two parts, there is no circulation of air, and dead air, no matter how warm, is never a good drying agent.

The boots should be hung three or four feet from the ground, where they may be



Establish air circulation in your wet rubber boots and they soon will be dry

swung a bit by the wind and where the sun strikes down upon them to heat the air. Of course a slight breeze aids in the drying process. Strips of wood or bark will do as well as the roofing-paper.—F. E. BRUNNER.

Varnish Made from Hard-Rubber Waste

A GOOD flexible varnish can be made out of wasted bits of vulcanized rubber that will come in handy for general use around the home and workshop. It is especially valuable in waterproofing shoes, and for cementing patches on automobile tires and worn rubbers.

To make it, proceed as follows: Place the hard rubber pieces, broken into small bits, in an iron pot that closes well with a cover. Put the utensil on a hot coal fire until the rubber is melted, which will require about five or ten minutes. Make sure that every piece is melted before removing the pot from the fire. This can be ascertained by stirring the mass with a thick wire. Next grease a sheet of metal so that the molten rubber will not stick to it when cold. Then take the melted rubber from the fire and pour it on the metal plate to cool. Break up the mass into pieces and put them into a bottle, filling the latter with either rectified oil of turpentine or benzol.

When the mass is completely dissolved, which may be accelerated by shaking, pour off the solution carefully so as to avoid the impurities always found in hard rubber. These usually settle to the bottom of the bottle.

Our New Trade Mark!



Good Carpentry Begins With Good Tools

Stanley Carpenters' Tools are the world's standard—the best, and, therefore, the cheapest tools you can buy.

Stanley Carpenters' Tools

are preferred not only in the workshops of the world, but in the Manual Training Schools and in the homes as well.

Always ask for Stanley Tools, and be sure you get them. Look for the Trademark.

Write for Catalog 7E.

THE STANLEY RULE & LEVEL PLANT.
THE STANLEY WORKS
NEW BRITAIN, CONN. U.S.A.



Red Devil

REG. U.S. PAT. OFF.

That's all you need to know about a plier

This is your assurance that each tool is made as well as care, experience, finish and the best workmanship can make it.

Each tool drop forged of tool steel—scientifically designed—individually tempered and tested. "Red Devil" Pliers are high quality tools, not high priced. Look for the trade mark on each and every one—it's worth your while.

Red Devil

REG. U.S. PAT. OFF.

Slip-Joint Plier No. 1024

The right pair of pliers for household repairs, for wiring up the engine, and for light work of all kinds. Handles fit the hand without pinching—the thin nose fits in tight places. Beautifully nickel plated.

At all good hardware dealers, or if not, send \$1.10 for "Red Devil" Plier No. 1024—6½ inch. size.

WRITE TODAY FOR FREE TOOL BOOKLET

SMITH & HEMENWAY CO., Inc.
Manufacturers of "Red Devil" Tools
264 Broadway, - - - New York, N. Y.

"Red Devil" Glass Cutters are made in 40 styles—the glassers' standard tools of the world.



**"As hard as fire and
water can make them"**

—The Disston file-maker

Disston makes between sixteen and eighteen million files a year. Some weigh a tiny fraction of an ounce. Others 135 lbs. Some are for a lady's fingernails. Some for gigantic chunks of steel.

The supreme test of a good file is in filing the teeth of saws—steel cutting steel. And nearly a half-million Disston Files are used yearly in making Disston Saws—"the saws most carpenters use." No wonder Disston Files eat through the work in quick time! No wonder the experienced filer enjoys the feel of a Disston File as it bites into the toughest metal!

Disston Files are Disston-made from the steel to the packing case. They are of good, true steel, "as hard as fire and water can make them."

Send for new free booklet, "The File in History."



Reg. U. S. Pat. Off.

HENRY DISSTON & SONS, INC.
Philadelphia, U. S. A.

A List of What Disston Makes

And in these Saws, Tools and
Files is that quality found in

"The Saw Most Carpenters Use"

Back Saws

Band Saws for Wood and Metal

Bevels



Buck Saws

Butcher Saws and Blades

Circular Saws for Wood, Metal,
and Slate

Compass Saws

Cross-cut Saws and Tools

Cylinder Saws

Drag Saw Blades

Files and Rasps

Grooving Saws

Gauges—Carpenters'

Marking, etc.

Hack Saw Blades

Hack Saw Frames

Hand, Panel, and Rip Saws

Hedge Shears



Ice Saws

Inserted Tooth

Circular Saws

Keyhole Saws

Kitchen Saws

Knives—Cane, Corn, Hedge

Knives—Circular—for Cork,

Cloth, Leather, Paper, etc.

Knives—Machine

Levels—Carpenters' and Masons'

Machetes

Mandrels

Milling Saws for Metal

Mitre-box Saws

Mitre Rods

One-man Cross-cut Saws

Plumbs and Levels

Plumbers' Saws

Pruning Saws

Re-saws

Saw Clamps and Filing Guides



Saw Gummers

Saw-sets

Saw Screws

Screw Drivers

Screw-slotting Saws

Segment Saws

Shingle Saws

Slate Saws—Circular

Squares—Try and Mitre

Stave Saws

Sugar Beet Knives

Swages

Tools for Repairing Saws

Tool Steel

Trowels—Brick, Plastering,

Pointing, etc.

Veneering Saws

Webbs—Turning and Felloe



This is a partial list. There are thousands
of items in the complete Disston list.

DISSTON

SAWS TOOLS FILES

COLGATE'S

"HANDY GRIP"

The Refill Shaving Stick



**You don't throw
your pen away
when it needs refilling**

NOR is it necessary to buy a new "Handy Grip" when your Shaving Stick is all used. Just buy a Colgate "Refill," for the price of the soap alone, screw it into your "Handy Grip," and you are "all set" for another long season of shaving comfort.

The soap itself is threaded. There is no waste.

Colgate's Shaving Stick not only produces the most soothing lather for the average man but it is a little more economical in use than powder and much more economical than cream. As we make all three, we can give you this impartial advice.

COLGATE & CO. Dept. R 199 Fulton St., New York
In Canada: 137 McGill Street, Montreal

The metal "Handy Grip," containing a trial size stick of Colgate's Shaving Soap, sent for 10c. When the trial stick is used up you can buy the Colgate "Refills," threaded to fit this Grip.



Sure enough, the old bus went back on me



IT WAS a while,
OF A hill, and the old bus,
GROANED AND shuddered,
AND FINALLY stalled.
AND YOU could try eyes,
ON THE radiator,
WELL, WHAT I know,
ABOUT BUZZ wagons,
COULD BE written big
ON A postage stamp,
BUT I fiddled around,
AND TORE my new shirt,
AND GOT all smeared up,
THE ENGINE would start,
BUT LIZZIE wouldn't,
NOT ON that hill.
SO I quit and lit up,
ONE OF my cigarettes,
AND THOUGHT it over,
THEN I had a hunch,
PUSHED HER around,
PULLED A thing-a-ma-jig,
AND THE blame boat,
BACKED UP the hill.

WITHOUT EVEN hesitating,
SO I learned a trick,
WHICH EVERY driver,
SHOULD REMEMBER,
WHEN IN doubt, light up,
A "SATISFY" cigarette,
FOR WITH one of those,
GEARED TO your teeth,
YOU CAN start anything.



IT didn't take much persuasion to get Chesterfields going—they're self-starters. That blend of fine Turkish and Domestic tobaccos makes friends by the millions. Another thing—you don't find a Chesterfield smoker "shifting" brands—he's in "high" all the time.

20 for 20 cents

In packages of 20 protected by special air-tight wrapper. Also in round tins of 50, vacuum sealed.

They Satisfy **Chesterfield**
CIGARETTES